AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
	1		2

2. AMENDMENT/MODIFICATION NUMBER	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQUISITION NUMBER	5. PROJECT NUMBER *(If applicable)*
0001	06/17/2026		

6. ISSUED BY CODE 70LGLY

DEPARTMENT OF HOMELAND SECURITY
FEDERAL LAW ENFORCEMENT TRAINING CENTERS
1131 CHAPEL CROSSING RD
GLYNCO GA 31524

7. ADMINISTERED BY *(If other than Item 6)* CODE 70LGLY

DEPARTMENT OF HOMELAND SECURITY
FEDERAL LAW ENFORCEMENT TRAINING CENTERS
1131 CHAPEL CROSSING RD
PRO BLDG 681
GLYNCO GA 31524

8. NAME AND ADDRESS OF CONTRACTOR *(Number, street, county, State and ZIP Code)*

CODE | FACILITY CODE

(X) **9A. AMENDMENT OF SOLICITATION NUMBER**
70LGLY26RSSB00019

☒ **9B. DATED** *(SEE ITEM 11)*
06/12/2026

10A. MODIFICATION OF CONTRACT/ORDER NUMBER

☐

10B. DATED *(SEE ITEM 13)*

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended. ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or electronic communication which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by letter or electronic communication, provided each letter or electronic communication makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NUMBER AS DESCRIBED IN ITEM 14.

CHECK ONE

☐ A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NUMBER IN ITEM 10A.

☐ B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation data, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).

☐ C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

☐ D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (*Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

See continuation page

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
		Courtney P. Brown	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(Signature of person authorized to sign)		*(Signature of Contracting Officer)*	

Previous edition unusable

STANDARD FORM 30 (REV. 11/2016)
Prescribed by GSA FAR (48 CFR) 53.243

NAME OF OFFEROR OR CONTRACTOR

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Amendment 0001 Solicitation 70LGLY26RSSB00019, B164 Ammo Range Cart Storage Facility is hereby issued for the following: 1. To provide Drawing BG0166 52 Golf cart facility dual OH doors floorplan 2. To provide Drawing BG0166 52 Golf cart facility dual OH doors front view 3. To provide Drawing BG0166 52 Golf cart facility Dual OH doors interior aerial view 4. To provide Drawing BG0166 Range cart aerial view site layout 5. To provide Attachment 9 - WH347_Weekly Certified Payroll Report Form Rev. Jan 2025 6. All other terms and conditions remain unchanged Period of Performance: 07/15/2026 to 01/11/2027				

STATEMENT OF WORK

BG0166 FAD OD Range cart storage facility

1/22/26

Section Index

SECTION 1

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SECTION 2

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SECTION 1

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 2114 (2008) Standard Terminology for Sustainability Relative to the Performance of Buildings

1.2 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E 2114, and as specified.

a) "Environmentally preferable products" have a lesser or reduced effect on the environment in comparison to conventional products and services. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

b.) "Indoor environmental quality" is the physical characteristics of the building interior that impact occupants, including air quality, illumination, acoustics, occupant control, thermal comfort, daylighting, and views.

c) "Operational performance" refers to the functional behavior of the building as a whole or of its components.

d.) "Sustainability" is the balance of environmental, economic, and societal considerations.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

Perform work on IAW contract: Drawings, specifications, reference documents, and contract provisions. Provide all labor, material, equipment, and supervision required to accomplish the following work:

1.3.1 Project Description

The contractor will furnish all labor, materials, equipment, and supervision necessary to accomplish the work detailed herein. The contractor will also verify all quantities, dimensions, and site conditions in the field. The contractor will supply all supplemental and related miscellaneous work to comply with the scope of work as indicated in the Specifications, Statement of Work, and/or Contract.

*NOTE: This project will comply with the Buy American Act whenever possible, ensuring the use of domestically produced materials and products in accordance with applicable regulations.

This project is for the design and construction of a range cart storage facility. The facility will provide secure and weather-resistant storage for Firearms Division range carts and related equipment. Utilizing a design-build approach, the project will integrate the design and construction phases to enhance efficiency, minimize costs, and ensure high-quality outcomes. The contractor will handle all parts of the project, including site evaluation, design, permitting, construction, and final delivery. The facility will meet all required codes, standards, and regulations while supporting operational needs and ensuring durability.

1.3.1a Site Preparation

Site preparation for the range cart storage facility will include all necessary activities to ensure the area is ready for construction. This will involve clearing and grading the site to create a level and stable foundation, removing any debris, vegetation, or obstacles. Soil testing and compaction will be performed as needed to ensure the ground can support the structure. Drainage systems will be installed as needed to prevent water accumulation and protect the facility from potential flooding. Utility connections, such as water, electricity, and other services, will be coordinated and prepared for integration into the building. All site preparation work will comply with applicable codes, regulations, and environmental requirements to ensure safety and long-term stability.

1.3.1a Demolition

Demolition and removal work for the installation of the range cart storage facility will include the removal of two existing light poles, earth, asphalt, trees, and any other items necessary to clear the site for construction. This process will involve safely disconnecting and removing the light poles, excavating and disposing of earth and asphalt materials, and clearing trees and vegetation while adhering to environmental regulations. Any additional items or structures that obstruct the installation of the building will also be removed. All debris and materials will be properly disposed of or recycled in compliance with local, state, and federal requirements. The demolition work will be conducted in a manner that minimizes disruption to surrounding areas and ensures the site is fully prepared for the next phase of construction.

1.3.1b Construction

Note: Drawings will be provided as separate attachments to be used “for reference” for the following:

a) The project involves the installation of an approximately 80' x 160' steel metal building with approximately 12’ eave height on a concrete slab, which will include electrical, water, and sewer connections to support operational needs. The building will feature gutters along both long sides with downspouts for proper drainage and will be equipped with 4-inch-thick insulation to enhance energy efficiency and climate control. The color of the building will be determined from manufacturers standard options.

   The building will be designed to support the load of ceiling-mounted fans, lighting, fire suppression systems, cart electrical retractable cord reels, and all other required equipment. The construction will include a minimum of 26-gauge roof and wall panels for durability. The building will meet wind speed requirements of at least 130 MPH, in accordance with the current local International Building Code (IBC). Concrete to be minimum 4000 PSI with fiber and #4 rebar on 12” centers or otherwise stated by the stamped engineered drawings.

b) The building will include two interior rooms to support specific operational functions. One room, approximately 12' x 12', will feature a secure, non-corrosive metal overhead coiling door with a FLETC approved locking mechanism, a sink for handwashing, and an eyewash/shower combination located outside the room for safety, along with a floor drain for proper water management. The second room will serve as an electrical room, equipped with a thermostat-controlled exhaust fan to regulate temperature and double doors on the exterior of the building for easy access.

c) The electrical system of the building will be designed to support the installation of electrical outlets throughout the building in compliance with code, large ceiling-hung fans, wall-mounted fans, overhead door operators, overhead lighting, spot heaters to maintain a

manageable temperature, and one 120-volt, 20-amp ceiling-mounted retractable cord reel for approximately 60 carts, plus an additional 2 for spares. The electrical design will also incorporate all other building systems and required components. The building's switchgear will be installed in the electrical room, which will feature double doors for easy access and maintenance.

d) Each long side of the building will include two 3/0 metal exterior doors with each having a half glass safety window and protected by exterior stainless steel non-corrosive removeable bollards and yellow sleeve covers for added safety and protection. Use FLETC approved locks and hardware. Doors are to have steel interior structure inside.

The two shorter ends of the building will serve as entrance and exit points, each featuring two metal overhead roll-up doors positioned approximately as shown in the attached drawing, allowing for a roadway for the carts. Additionally, each end will feature a standard 3/0 metal door steel interior structure with a half-glass safety window, FLETC approved hardware and locks, and protected by exterior stainless steel non-corrosive removeable bollards and yellow sleeve covers for added safety and protection. To ensure proper ventilation, a gable fan will be installed at each end of the building, sized to provide adequate airflow.

The overhead roll-up doors will be equipped with electric operators featuring chain assistance for ease of use and reliable operation. The basis of design for the roll-up doors is Overhead Door model 625 or an approved equal meeting all salient characteristics. The basis of design for the overhead door operator is Overhead Door model RHX or an approved equal meeting all salient characteristics. Six remote door operators will be provided, with each remote capable of operating all four roll-up doors` independently. Each roll up door will also have an interior mounted open-close-stop momentary switch for operation of the door. Each roll up door will incorporate a bottom mounted pressure edge for safety. All doors and operators will be programmed and thoroughly checked to ensure proper operation. This includes verifying functionality, remote compatibility, and compliance with project requirements to guarantee reliable and efficient performance.

Each end of the building with roll-up doors will be equipped with a minimum of one LED floodlight. The floodlights will provide adequate illumination for the entrance and exit areas to ensure safety during after-hours use. The lighting will be positioned to effectively cover the roadway and surrounding areas for clear visibility and safe operation.

The building will include eave vents and ridge cap vents to ensure proper airflow and ventilation. Both types of vents will be designed to allow easy closure when needed, providing flexibility to control airflow based on environmental conditions or operational requirements.

The area near the cart repair storage room will include a wall-mounted variable speed fan to ensure proper air circulation. Basis for design is Big Ass fans Aireye or other approved equal with salient characteristics. The fans shall be manufactured in the USA to meet project requirements and ensure compliance with applicable standards. This fan will enhance ventilation in the immediate area, supporting a comfortable and safe environment for operations and equipment maintenance.

The building will include a minimum of three large overhead variable speed fans strategically installed throughout the interior to ensure proper airflow for equipment cooling and ventilation. Basis for design is Big Ass Fans PowerFoil X4 or other approved equal with salient characteristics. The fans shall be manufactured in the USA to meet project requirements and ensure compliance with applicable standards. These fans will be designed to enhance air circulation, maintain a safe environment, and support the efficient operation of equipment within the building.

e) The building shall be equipped with a foam-type fire suppression system specifically designed to accommodate various battery chemistries. This system will provide effective fire protection tailored to the unique risks associated with battery storage and handling, ensuring safety and compliance with applicable fire codes and standards.

The building will be equipped with a heat detection system and a fire alarm panel designed to integrate seamlessly into FLETC's existing fire alarm system. This setup will ensure early detection of potential fire hazards and provide reliable communication with the broader safety infrastructure for prompt response and enhanced protection.

***NOTE:** Honeywell Notifier fire alarm panel and devices will be required for this project. The Contracting Officer (CO) will maintain possession of the brand name justification document.

1.4 SUBMITTALS

Submittals are required for all material and equipment items. They must be reviewed and approved prior to ordering materials and starting construction.

a) All products and/or materials shall conform to the requirements and related specifications of this Statement of Work and shall be first quality, complying with all standards and applicable building codes.

b) The Contractor shall provide submittals to the Contracting Officer Representative (COR). Submittals shall include, but not be limited to, material data sheets, drawings, manufacturer's installation details, AHA & CPL, fall protection plans, Hot Work permits, construction schedule and other documents as required.

***The PM or other government-approving official must verify that all materials comply with the SOW and approved submittals prior to installation and/or the start of construction. If the contractor fails to comply, the CO will be notified immediately that the contractor is not in compliance with the SOW or approved submittals**.

Government approval is required for all submittals, including:

a) Project schedule - Proposed construction dates

b) AHA and CPLs, Accident Prevention Plan, Health and Safety Plan

c) Quality Control plan, Environmental plan, and Work plan

d) Steel building stamped engineered drawings to include foundation

e) Electrical equipment: All wire/cable, breakers, switchgear and all other required electrical components

f) Exhaust fans including gable and electrical room

g) Overhead coil doors, operators, controls, and remotes

h) Coil grill door and hardware for the cart repair storage area

i) Stainless steel removeable bollards and plastic yellow covers

j) Exterior Doors and hardware

k) Commercial electrical cord reels

l) Sink and eyewash/shower combo

m) Floor drain

n) Sewer and drain piping

o) Large ceiling mounted fans and wall mounted fans

p) Foam fire suppression system and shop drawings

q) Heat detection and fire alarm system and shop drawings

r) All paint/coatings, chemicals, including non-corrosive spray

s) Certificates Of Insurance

t) Security Bonds

u) Submittal Register

v) Schedule Of Prices or Earned Value Report

1.5 LOCATION

The work shall be located at the FLETC, GLYNCO GA. Campus, building 252. The exact location will be shown by the Contracting Officer/Contracting Officer's Representative during the site visit.

1.6 CONTRACT DRAWINGS

The following drawings accompany this specification and are a part thereof.

See section 3.3 for attachments.

1.7 BADGING

a) All Government Contractors require badging to enter the FLETC.

b) All badging applications for Contractors and their Subs must be submitted to the Project Manager/Engineer at the time of the Pre-construction meeting if a Pre-construction meeting is required.

c) The Superintendent/QC will be required to keep an updated spreadsheet of all badges associated with this contract.

d) The Spreadsheet shall consist of the following: Company Name, Individual Name, Contract Number, and badge status (Picked up, processing, waiting on fingerprints, etc.). It shall be readily available for the Project Manager and brought to the progress meeting that will be scheduled every two weeks.

1.8 WORK RESCHEDULING

Normal duty hours for work shall be from 7:30 a.m. to 5:30 p.m., Monday through Friday. Requests for additional work shall require written approval from the Contracting Officer 7 days in advance of the proposed work period.

NOTE: Building(s) may be occupied during performance of work under this Contract. Before work starts, arrange with the Contracting Officer a sequence of procedures, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

a) Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work. Submit a written Transportation of Personnel, Materials, and Equipment Plan describing access procedures throughout the project duration.

b) If occupied, building 252 will remain in operation during the entire construction period. The Contractor must conduct his operations to cause the least possible interference with normal activity. Work must be coordinated with circulation patterns within the building. Circulation patterns cannot be closed off entirely.

c) Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing at least 15 calendar days before the desired date of interruption.

d) The work under this contract requires special attention to scheduling and conducting the work in connection with existing operations. Identify on the construction schedule each factor that constitutes a potential interruption to operations.

1.9 COORDINATION, QUALITY CONTROL, AND ASSURANCE

a) Coordinate construction schedule and all construction operations with the Contracting Officer Representative (COR).

b) The Superintendent / QC is responsible for ensuring that all work performed is in accordance with the terms of the Contract.

c) All work is to be inspected by the Government and accepted before the issuance of final payment.

d) The contractor shall verify all measurements, locations, and requirements of the job.

e) The contractor shall keep the construction area maintained throughout the project.

f) All deliveries SHALL be coordinated with the Government Project Manager/COR, all deliveries shall be delivered to the FLETC back gate off Vogel Rd.

g) If the information in the Contract conflicts with that in this Statement of Work, the Contract shall take precedence.

h) The Contractor shall preserve and restore the site ecosystem and biodiversity, avoid site degradation and erosion, and minimize offsite environmental impact.

1.10 PROJECT ENVIRONMENTAL GOALS

The contractor shall distribute copies of the Environmental Goals to each subcontractor and the Contracting Officer. The overall goal for design, construction, and operation is to produce a building that meets the functional program needs and incorporates the principles of sustainability. Specifically:

a) Preserve and restore the site ecosystem and biodiversity; avoid site degradation and erosion. Minimize off-site environmental impact.

b) Use the minimum amount of energy, water, and materials feasible to meet the design intent. Select energy and water-efficient equipment and strategies.

c) Use environmentally preferable products and decrease the toxicity level of materials used.

d) Use renewable energy and material resources.

e) Optimize operational performance (through commissioning efforts) to ensure energy-efficient equipment operates as intended. Consider the durability, maintainability, and flexibility of building systems.

f) Manage the construction site and storage materials to ensure no negative impact on the building's indoor environmental quality.

g) Reduce construction waste through reuse, recycling, and supplier take-back.

1.11 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

a) Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b) Repair or replace portions of existing work, which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.12 ON-SITE PERMITS

Notify the PM and the Contracting Officer at least 48 hours prior to starting excavation work. The contractor is responsible for marking and verifying all utilities. The Contractor shall verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed. Work shall be scheduled to hold outages to a minimum.

Requests for utility outages and connections shall be made by writing to the Contracting Officer and PM at least 2 calendar days in advance of the time required. Each request shall state the system involved, the area involved, the approximate duration of the outage, and the nature of the work involved.

1.13 UTILITY OUTAGE REQUESTS AND UTILITY CONNECTION REQUESTS

Notify the Contracting Officer at least 48 hours before starting the excavation work. The contractor is responsible for marking and verifying all utilities.

The Contractor shall verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified that needs removal. Requests for utility outages and connections need to be in writing to the Contracting Officer at least two days in advance of the time required. Each request shall state the system involved, the area involved, the approximate duration of the outage, and the nature of the work involved. Schedule work to hold outages to a minimum.

1.14 LOCATION OF UNDERGROUND FACILITIES

1.14.1 Notification Prior to Excavation

The contractor shall properly locate all underground utilities by contacting Georgia 811 and FLETC Facilities Management Divisions, Operations Branch (912-267-2413). All utility locates must be called at least one (1) week before beginning work. The 811 locate ticket number and the FLETC Operations Work Order number must be presented to the COR before work begins. Locates have an expiration date; if the locate expires before work has been completed, the contractor shall contact Georgia 811 for a new locate.

SECTION 2 PRODUCTS

Ensure that all products used in the project meet the specified requirements and are installed according to the manufacturer's guidelines and industry standards to ensure the longevity and performance of all installed products.

SECTION 3 EXECUTION

3.1 PERIOD OF PERFORMANCE

Period of performance not to exceed 180 calendar days in which to complete this project from Notice to Proceed (NTP). Notice to proceed shall be issued once all materials are on site and all badging has been approved.

3.2 INSTALLATION

a) All products and materials are installed and constructed using the manufacturer's published instructions, specifications, and industry standards.

b) No product and/or materials shall be installed without the Contractor first receiving written approval from the COR/Engineer regarding submittal items. Materials used on this project are to be submitted and approved/approved prior to use.

c) Acceptance of products/materials shall be accomplished by either furnishing testing results conducted during manufacturing, furnishing manufacturing certification followed by the results of random verification testing, or pre-approving and testing a product or its components prior to utilization.

d) The contractor shall verify all dimensions and conditions prior to beginning work or ordering materials. The contractor shall review site conditions with the Project Manager prior to ordering materials and starting work.

e) The Contractor shall properly locate all underground utilities by contacting Georgia 811 and FLETC Facilities Management Divisions, Operations Branch (912-267-2413). All utility locates must be called at least one (1) week before beginning work. The 811 locate ticket number and the FLETC Operations Work Order number must be presented to the COR before work begins. Locates have an expiration date; if the locate expires before work has been completed, the contractor shall contact Georgia 811 for a new locate.

f) No product and/or materials shall be backfilled without first being inspected by the COR. Any product and/or materials backfilled without first being inspected by the COR shall be excavated at the Contractor's expense to allow for inspection as required by this section of the Statement of Work.

g) Clean out of concrete trucks hauling cast-in-place concrete shall not occur on FLETC property.

h) All work shall be installed/constructed in accordance with specifications, manufacturer-published instructions, and industry standards.

i) All work shall be performed utilizing the latest codes for the work to be accomplished.

j) Material generated by excavation and demolition activity shall fully be recycled when possible, and quantities of all regular wastes and recyclables shall be documented in accordance with the requirements of Specification Section 01 57 19.00 20 entitled “Temporary Environmental Controls”. All waste material shall be disposed of off FLETC property, in accordance with applicable federal, state, and local regulations. The contractor is to provide COR with documentation of the weights of all materials (segregated by material types) recycled and disposed of.

k) *Note: FLETC maintains a sole-source contract with Certified Controls. The contractor must coordinate with Certified Controls to provide and install a proper control system.

3.3 ATTACHMENTS

Attachment “A” – Fire Suppression System design and commissioning

-See the following page-

"Attachment A"

1. Scope:
The contractor shall design, furnish, and install an automatic fire suppression system for the new building as part of this design/build project. The system shall comply with all applicable federal, state, and local fire codes, standards, and regulations, including but not limited to the National Fire Protection Association (NFPA) standards. The contractor shall engage a qualified Fire Protection Engineer (FPE) to evaluate the building's requirements and design a suppression system tailored to the specific application and use of the facility.

2. Requirements:

2.1 Fire Protection Engineer (FPE):
- The contractor shall retain a licensed and certified Fire Protection Engineer (FPE) to evaluate the building's fire protection needs.
- The FPE shall conduct a thorough assessment of the building design, intended use, occupancy type, fire hazards, and applicable codes and standards to determine the most appropriate fire suppression system.
- The FPE shall provide stamped and signed design drawings and calculations for the fire suppression system.

2.2 Design:
- The fire suppression system shall be designed to provide adequate protection for the building and its occupants based on the building's intended use and occupancy classification.
- The design shall comply with NFPA standards, including but not limited to NFPA 13 (Standard for the Installation of Sprinkler Systems), NFPA 14 (Standard for the Installation of Standpipe and Hose Systems), NFPA 20 (Standard for the Installation of Stationary Pumps for Fire Protection), and NFPA 72 (National Fire Alarm and Signaling Code), as applicable.
- The system design shall include all necessary components, such as sprinkler heads, pipes, valves, pumps, control panels, and alarms, to ensure full functionality and compliance.
- The FPE shall evaluate and recommend the type of suppression system most suitable for the building (e.g., wet pipe, dry pipe, pre-action, or other specialized systems).

2.3 Installation:
- The contractor shall furnish all materials, equipment, and labor necessary to install the fire suppression system in accordance with the approved design.
- Installation shall be performed by qualified personnel with experience in fire suppression systems.
- The contractor shall coordinate with other trades to ensure seamless integration of the fire suppression system with the building's construction and systems.

2.4 Testing and Commissioning:
- Upon completion of installation, the contractor shall perform all required testing and commissioning of the fire suppression system to ensure proper functionality and compliance with applicable standards.
- Testing shall include hydrostatic testing, flow testing, alarm testing, and any other required tests as specified by NFPA standards.

- The contractor shall provide documentation of all tests and certifications to the Contracting Officer or designated representative.

2.5 Documentation and Training:

- The contractor shall provide as-built drawings, system manuals, and maintenance instructions for the fire suppression system.
- The contractor shall conduct training for facility personnel on the operation and maintenance of the system.

3. Deliverables:

- Fire suppression system design drawings and calculations stamped by the FPE.
- Documentation of testing and commissioning results.
- As-built drawings and system manuals.
- Training for facility personnel.

4. Compliance: The fire suppression system shall comply with the following standards and regulations:

- NFPA standards (e.g., NFPA 13, NFPA 14, NFPA 20, NFPA 72, etc.).
- International Building Code (IBC).
- International Fire Code (IFC).
- Local and state fire codes and regulations.

5. Schedule:

The contractor shall ensure the fire suppression system design, installation, testing, and commissioning are completed in accordance with the overall project schedule.

6. Quality Assurance:

The contractor shall implement quality assurance measures to ensure the fire suppression system meets all design and performance requirements.

Federal Law Enforcement Training Centers

GLYNCO, GEORGIA

-End of Statement-

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23 03 00.00 20	Basic Mechanical Materials and Methods
23 05 93	Testing, Adjusting, and Balancing for HVAC
23 07 00	Thermal Insulation for Mechanical Systems
23 08 00.00.23N	Commissioning of HVAC Systems
23 09 23.13 20	BACnet Direct Digital Control Systems for HVAC
23 81 00.00 20	Unitary Air Conditioning Equipment
23 82 00.00 20	Terminal Heating Units
26 00 00.00 20	Basic Electrical Materials and Methods
26 08 16	Commissioning of Electrical Systems Support
26 20 00	Interior Distribution System

26 23 00	Switchboards
26 41 01.00 10	Lighting Protection System
26 51 00	Interior Lighting
26 56 00	Exterior Lighting
27 05 14.00 10	Cable Television Premises Distribution System
27 10 00	Building Telecommunications Cabling System
28 31.64.00 10	Fire Protection and Alarm System, Addressable
31 00 00	Earthwork
31 11 00	Clearing and Grubbing
31 31 16	Soil Treatment for Subterranean Termite Control
32 05 33	Landscape Establishment
32 10 00	Bituminous Concrete Pavement
32 16 13	Concrete Sidewalks and Curbs and Gutters
32 17 24.00 10	Pavement Markings
32 92 19	Seeding
32 93 00	Exterior Plants
33 11 00	Water Distribution
33 30 00	Sanitary Sewers
33 40 00	Storm Drainage Utilities
33 71 02	Underground Electrical Distribution

SECTION 01 14 00

WORK RESTRICTIONS

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Not used

1.2 NOT USED

1.3 CONTRACTOR ACCESS AND USE OF PREMISES

1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. To minimize traffic congestion, delivery of materials shall be outside of peak traffic hours (6:30 to 8:00 a.m. and 3:30 to 5:00 p.m.) unless otherwise approved by the Contracting Officer. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.3.1.1 Subcontractors and Personnel Contacts

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.3.1.2 Identification Badges and Installation Access

Identification badges are required and will be furnished without charge. Application for and use of badges will be as directed by the Contracting Officer. Immediately report instances of lost or stolen badges to the Contracting Officer. See Section H regarding lost badges. All badges must be immediately returned to the point of issue upon badge expiration, contract completion, firing or removal of employee, or at the request of the approving authority.

1.3.1.3 Employee List

The Contractor shall provide to the Contracting officer, in writing, the names of two designated representatives authorized to request personnel and vehicle passes for employees and subcontractor's employees prior to commencement of work under this contract.

1.3.1.4 Personnel Entry Approval

Failure to obtain entry approval will not affect the task order price or time of completion.

1.3.1.5 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installations under the cognizance of FLETC except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.3.2 Working Hours

Normal working hours shall consist of an 8 hour period established by the Contractoing Officer, between 7:30 a.m. and 4:30 p.m., Monday through Friday, excluding Government holidays.

1.3.3 Work Outside Regular Hours

Work outside (Normal) working hours requires Contracting Officer approval. Make application 3 to 5 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.

1.3.4 Occupied and Existing Buildings

The Contractor will be working in existing occupied buildings.

The existing buildings and their contents shall be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the building during the construction period.

1.3.5 Utility Cutovers and Interruptions

a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."

b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and sprinkler shall be considered utility cutovers pursuant to the paragraph entitled "Work Outside Normal Hours." Such interruption shall be further limited to 8 hours. This time limit includes time for deactivation and reactivation.

d. Operation of Station Utilities: The Contractor shall not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

1.4 SECURITY REQUIREMENTS

1.4.1 Citizenship Requirements

Aliens are not allowed on the project site. Work under this contract is restricted to U.S. citizens.

1.4.2 Documents Acceptable for Proof of Citizenship

a. Birth registration card

b. Certificate of live birth, birth certificate

c. Certificate of registration

d. Delayed birth certificate

e. Hospital birth certificate

f. Military officer ID card

g. USA passport

1.4.3 Passes

Submit request for personnel and vehicle passes together. Include the Certificate of Insurance for Contractor and Subcontractor(s) and the Statement of Acknowledgement Form SF 1413 with the submittal. Passes will normally be issued within 21 days, see Section H.

1.4.3.1 Control

Maintain strict accountability over passes. Immediately report to the source of issue, passes missing or lost and the circumstances.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

Requirements of this Section apply to, and are component to, each section of the specifications.

The Government may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Contractor's Quality Control Manager (QCM) to check and approve all items prior to submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval will be identified by each task order and are to be scheduled and made prior to the acquisition of the material or equipment covered thereby.

Submittals will be received from the Contractor and returned to the Contractor in designated mail boxes located at the FMD Office Building 200.

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Certificates of insurance
Surety bonds
Qualifications, Certifications, Resumes, Letters of Commitment, and Appointment Letters for all Key Personnel: Quality Control Manager (QCM), Alternate Quality Control Manager, Project Manager(PM), Alternate Project Manager, Superintendent, and Alternate Superintendent.
List of proposed subcontractors and suppliers
Accident Prevention and Health and Safety Plans
Quality Control (QC) plan
Environmental Protection and Waste Management Plan
Indoor Air Quality Management Plan
Activity Hazard Analysis (AHA) (designated per Task Order)

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.1.2 Approving Authority

Project Manager/COR designated person authorized to approve submittal.

1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTALS

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

SD-01 Preconstruction Submittals

> The below listed Pre-Construction Submittals are critical, if the award constitutes pre-construction submittals to start work activities and are required to be provided to the Government a minimum of seven (7) calendar days, (unless stated other-wise stated in the SOW, per task order), prior to the scheduled Preconstruction Conference and will require Government approval prior to Notice to Proceed and work commencement on site. Make any required Pre-Construction Re-Submittals within five (5) calendar days after Government rejection. Neglect to provide timely approved Pre-Construction submittals and to employ approved key on-site Project Manager, Quality Control Manager and Superintendent personnel will not be the basis for time extension, claim under the Contract, nor will it be subject to the Disputes clause. Submit four (2) submittal copies for Government retention PLUS the number of copies requested for return back to the Contractor.

See the related Division 1 specification sections such as Quality Control, Project Schedule, Environmental Controls/Management, Waste Management, Safety Requirements:

Certificates of insurance; Surety bonds;
Qualifications, Certifications, Resumes, and Appointment Letters for Quality Control Manager, Project Manager and Superintendent; List of proposed subcontractors and suppliers;
Accident Prevention and Safety plan; Quality Control (QC) plan;
Environmental Protection and Waste Management plan; Indoor Air Quality Management Plan
Schedule
Activity Hazard Analysis(AHA)for and DOFW per Task Order

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved

Submittal is required in accordance with all contract requirements and prior to fabrication, delivery, and start of any related work activity. The Government reserves the right to suspend work activities initiated without approved submittals. Government approval is required for submittals identified in each task order. Government approval is required for any deviations from the Accepted Proposal and other items as designated by the Contracting Officer.

1.3.2 QCM Approved - Information Only

Submittals not requiring Government approval will be approved by the Quality Control Manager and made available to the Government if requested for information only. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Government from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.4.1 Submittals Required from the Contractor

Required submittals must be approved in writing by a Government Representative(PM/COR) before procurement or fabrication of any proposed materials or methods in the (SOW) per for each task order. Forward the required submittals to the Project Manager/COR and copy the Contracting Officer with the FMD-74 transmittal sheet. The Government PM for each task order will review stamp submittals to verify submittals comply with the contract requirements.

1.4.1.1 O&M Data

The Government PM for each task order will review O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

a. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to the Project Manager/COR. Transmit each copy of the submittal in the format of the Agency sample transmittal form FTC-FMD-74 furnished by the Government. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample mock-ups, installations, panels.

Properly complete this form by filling out all the heading blank spaces and identifying each item submitted by section, submittal description (SD) number, and paragraph reference number. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item. Assign each submittal a transmittal number.

1.5.2 Identifying Submittals

When submittals are provided by a lower tier contractor the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Task Order title and location.

b. Task Order number.

c. Date of the submittal.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier Contractor associated with submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. For resubmittals, add an alphabetic suffix on the submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

i. Quality Control Manager's certification stamp.

1.5.3 Format for SD-02 Shop Drawings

a. Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

b. Present A4 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."

d. Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

e. Reserve a blank space on the right hand side of each sheet for the Government disposition stamp.

f. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

g. Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

h. Reproductions of the task order drawings will not be accepted as shop drawings. Such submittals will be rejected.

1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

a. Present product data submittals for each section as a complete set. Include table of contents, listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

c. Provide product data in English dimensions.

d. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

e. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

f. Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically.

g. Submit manufacturer's instructions prior to installation.

1.5.5 Format of SD-04 Samples

a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

(1) Sample of Equipment or Device: Full size.

(2) Sample of Materials Less Than 2 by 3 inches: Built up to A4 8 1/2 by 11 inches.

(3) Sample of Materials Exceeding A4 8 1/2 by 11 inches: Cut down to A4 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

(4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

(5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

(7) Sample Panel: 4 by 4 feet.

(8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.5.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

a. Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

b. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.5.8 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

b. Provide all dimensions in administrative submittals in English units.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies on SD-01 Preconstruction Submittals

Submit four copies of Preconstruction submittals.

1.6.2 Number of Copies of SD-02 Shop Drawings

Submit three copies of submittals of shop drawings.

1.6.3 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.4 Number of Samples SD-04 Samples

a. Submit three samples or sets of samples showing range of variation, of each required item. Two approved samples or sets of samples will be retained by approving authority and one will be returned to Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit three samples of non-solid materials.

1.6.5 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.6.6 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.7 Number of Copies of SD-10 Operation and Maintenance Data

Submit two copies of O&M Data to the Government for review and approval.

1.6.8 Number of Copies of SD-11 Closeout Submittals

Unless otherwise specified, submit two sets of Close-Out submittals.

1.6.9 Copies Not Indicated

Provide two copies of submittals when a number of submittal copies are not otherwise identified.

1.7 VARIATIONS / SUBSTITUTION REQUESTS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.7.1 Considering Variations

Discussion with Contracting Officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.7.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.7.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.7.4 Variations Review Schedule

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.8 SUBMITTAL REGISTER

The Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

Coordinate the submittal dates with the related project activities to avoid any delay to work progress. Revise the submittal register when the progress schedule is revised and submit both for approval.

1.8.1 Use of Submittal Register

Verify that all submittals required for a task order are tracked in the submittal register.

1.9 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time.No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirement and refer to time period in section 1.2 Submittals.

1.9.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is the QC Manager unless submittals are specifically identified in a task order. Request for submittals in a task order signifies the requirement for Government Approval for only those submittals identified.

1.9.2 Constraints

a. Conform to provisions of this section, unless explicitly stated otherwise by a task order.

b. Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.9.3 QC Organization Responsibilities

It is the responsibility of the QC manager to coordinate all submittals with subcontractors, manufacturers, suppliers, etc. to insure all submittals are complete and represent entire systems where multiple subcontractors, supplier, etc. combine to make up an operating system.

a. Note date on which submittal was delivered by Contractor on each transmittal.

b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.

c. Review submittals for conformance with task order design concepts and compliance with contract documents.

d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

e. Ensure that material is clearly legible. Submittals containing illegible materials will be entirely rejected.

f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is Project Manager/COR, QC organization will certify submittals forwarded to Project Manager/COR with the following certifying statement:

"I hereby certify that the equipment, material, article shown and marked in this submittal is that proposed to be incorporated with contract Number__, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Certified by QC Manager_____, Date_____"
(Signature)

(2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the material, equipment, article shown and marked in this submittal and proposed to be incorporated with contract Number, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Approved by QC Manager_____, Date_____"
(Signature)

g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.

Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Government.

i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

1.10 GOVERNMENT APPROVING AUTHORITY

When approving authority for submittals is the Project Manager/COR the Government will:

a. Note date on which submittal was received from QC Manager.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph entitled "Submittal Actions" and with markings appropriate for action indicated.

Two copies of approved submittals will be retained by the Government and the remaining copies of the submittal will be returned to the Contractor, excluding O&M and Close-Out submittals.

1.10.1 Review Notations

Submittals will be returned with the following notations:

a. Submittals marked "approved" authorize the Contractor to proceed with the work covered.

b. Submittals marked "approved as noted" "or approved except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required , does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.11 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Government. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the task order drawings or specifications; notice as required under the clause entitled, "Changes" is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.12 APPROVED SUBMITTALS

The Government's approval or acceptance of submittals is not be construed as a complete check. Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for verification of dimensions and the compliant construction of all work.

After submittals have been approved or accepted by the Government, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.13 APPROVED SAMPLES

Approval of a sample is not to be construed to change or modify any contract requirements. Before submitting samples, the Contractor is to assure that the materials or equipment will be available in quantities required in the project. No substitution will be permitted after a sample has been approved.
Match the approved samples for Materials and equipment incorporated in the work. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to

disapproved any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Project Manager /COR for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Project Manager/COR does not relieve the Contractor of his responsibilities under the contract.

1.14 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made if all required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Contract.

1.15 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
E-mail: amca@amca.org
Internet: http://www.amca.org

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
2111 Wilson Blvd, Suite 500
Arlington, VA 22201
Ph: 703-524-8800
Fax: 703-528-3816
E-mail: fdietz@ahrinet.org
Internet: http://www.ahrinet.org

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209

Ph: 703-358-2960
Fax: 703-358-2961
Internet: http://www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-5774
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: webmaster@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
1 Davis Drive
P.O. Box 12215
Research Triangle Park, NC 27709
Ph: 919-549-8141
Fax: 919-549-8933
E-mail: leonardc@aatcc.org
Internet: http://www.aatcc.org

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
2025 M Street, NW, Suite 800
Washington, DC 20036
Ph: 202-367-1155
Fax: 202-367-2155
E-mail: info@americanbearings.org
Internet: http://www.abma-dc.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240
Ph: 513-742-2020 or 513-742-6163
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: http://www.acgih.org

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)
2700 Prosperity Ave., Suite 250
Fairfax, VA 22031
Tel: 703-849-8888
Fax: 703-207-3561
E-mail: infonet@aiha.org
Internet http://www.aiha.org

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 700

Chicago, IL 60601-1802
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Fax: 312-670-5403
Publications: 800-644-2400
E-mail: pubs@aisc.org
Internet: http://www.aisc.org

AMERICAN IRON AND STEEL INSTITUTE (AISI)
1140 Connecticut Avenue, NW, Suite 705
Washington, DC 20036
Ph: 202-452-7100
Fax: 202-463-6577
E-mail: webmaster@steel.org
Internet: http://www.steel.org

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)
P.O. Box 210
Germantown, MD 20875-0210
Ph: 301-972-1700
Fax: 301-540-8004
E-mail: alsc@alsc.org
Internet: http://www.alsc.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1819 L Street, NW, 6th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: info@ansi.org
Internet: http://www.ansi.org/

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)
10003 Derekwood Lane, Suite 210
Lanham, MD 20706
Ph: 301-459-3200
Fax: 301-459-8077
Internet: http://www.arema.org

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191-4400
Ph: 703-295-6300 - 800-548-2723
Fax: 703-295-6333
E-mail: member@asce.org
Internet: http://www.asce.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: http://www.ashrae.org

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

1800 East Oakton Street Des
Plaines, IL 60018-2187
Ph: 847-699-2929
Fax: 847-768-3434
E-mail: customerservice@asse.org
Internet:http://www.asse.org

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
901 Canterbury, Suite A
Westlake, OH 44145
Ph: 440-835-3040
Fax: 440-835-3488
E-mail: info@asse-plumbing.org
Internet: http://www.asse-plumbing.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Ph: 800-926-7337
Fax: 303-347-0804
E-mail: smorrison@awwa.org
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
550 N.W. LeJeune Road
Miami, FL 33126
Ph: 800-443-9353 - 305-443-9353
Fax: 305-443-7559
E-mail: info@aws.org or customerservice@awspubs.com
Internet: http://www.aws.org

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
E-mail: email@awpa.com
Internet: http://www.awpa.com

APA - THE ENGINEERED WOOD ASSOCIATION (APA)
7011 South 19th St.
Tacoma, WA 98466-5333
Ph: 253-565-6600
Fax: 253-565-7265
E-mail: help@apawood.org
Internet: http://www.apawood.org

ARCHITECTURAL WOODWORK INSTITUTE (AWI)
46179 Westlake Drive, Suite 120
Potomac Falls, VA 20165
Ph: 571-323-3636
Fax: 571-323-3630
E-mail: info@awinet.org
Internet: http://www.awinet.org

ARCNET TRADE ASSOCIATION (ATA)

E-M-mail: info@arcnet.com
Internet: http://www.arcnet.com/index.htm</URL

ASME INTERNATIONAL (ASME)
Three Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-854-7179 or 800-843-2763
Fax: 212-591-7674
E-mail: infocentral@asme.org
Internet: http://www.asme.org

ASSOCIATED AIR BALANCE COUNCIL (AABC)
1518 K Street, NW
Washington, DC 20005
Ph: 202-737-0202
Fax: 202-638-4833
E-mail: info@aabc.com
Internet: http://www.aabchq.com

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9585
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
355 Lexington Avenue
15th Floor
New York, NY 10017
Ph: 212-297-2122
Fax: 212-370-9047
E-mail: assocmgmt@aol.com
Internet: http://www.buildershardware.com

CALIFORNIA ENERGY COMMISSION (CEC)
Media and Public Communications Office
1516 Ninth Street, MS-29
Sacramento, CA 95814-5512
Ph: 916-654-4287
Internet: http://www.energy.ca.gov/

CARPET AND RUG INSTITUTE (CRI)
P.O. Box 2048
Dalton, GA 30722-2048
Ph: 800-882-8846 or 706-278-3176
Fax: 706-278-8835
Internet: http://www.carpet-rug.com

CAST IRON SOIL PIPE INSTITUTE (CISPI)
5959 Shallowford Road, Suite 419
Chattanooga, TN 37421
Ph: 423-892-0137
Fax: 423-892-0817
Internet: http://www.cispi.org

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)
1300 Sumner Avenue
Cleveland OH 44115-2851
Ph: 216-241-7333
Fax: 216-241-0105
E-mail: cffa@chemicalfabricsandfilm.com
Internet: http://www.chemicalfabricsandfilm.com/

COMPOSITE PANEL ASSOCIATION (CPA)
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176
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Fax: 703-724-1588
Internet: http://www.pbmdf.com

COMPRESSED GAS ASSOCIATION (CGA)
4221 Walney Road, 5th Floor
Chantilly, VA 20151
Ph: 703-788-2700
Fax: 703-961-1831
E-mail: cga@cganet.com
Internet: http://www.cganet.com

CONSUMER ELECTRONICS ASSOCIATION (CEA)
1919 South Eads St.
Arlington, VA 22202
Ph: 866-858-1555 or 703-907-7600
Fax: 703-907-7675
E-mail: cea@CE.org
Internet: http://www.CE.org

COPPER DEVELOPMENT ASSOCIATION (CDA)
260 Madison Avenue
New York, NY 10016
Ph: 212-251-7200
Fax: 212-251-7234
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Internet: http://www.copper.org

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)
513 West Broad St., Suite 210
Falls Church, VA 22046-3257
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Fax: 703-538-1736
E-mail: lwidzowski@eima.com
Internet: http://www.eima.com

FLUID SEALING ASSOCIATION (FSA)
994 Old Eagle School Rd. #1019
Wayne, PA 19087
Ph: 610-971-4850
E-mail: info@fluidsealing.com
Internet:www.fluidsealing.com

FM GLOBAL (FM)
270 Central Avenue

P.O. Box 7500
Johnston, RI 02919
Ph: 401-275-3000 ext. 1945
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E-mail: servicedesk.myrisk@fmglobal.com
Internet: http://www.fmglobal.com

FOREST STEWARDSHIP COUNCIL (FSC)
212 Third Avenue North
Suite 280 Minneapolis,
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Internet: http://www.fscus.org

GEORGIA DEPARTMENT OF NATURAL RESOURCES

2 Martin Luther King Jr. Drive, SE
Suite 1252, East Tower
Atlanta, GA 30334
Ph: 404-656-3500
Internet: <URL>http://www.gadnr.org</URL>

GLASS ASSOCIATION OF NORTH AMERICA (GANA)
2945 SW Wanamaker Drive, Suite A
Topeka, KS 66614
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Internet: http://www.glasswebsite.com

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Fax: 202-872-4324
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Internet: http://www.greenseal.org

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)
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Ph: 800-427-9681
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E-mail: info@greenguard.org
Internet: http://www.greenguard.org/

GYPSUM ASSOCIATION (GA)
6525 Belcrest Road, Suite 480
Hyattsville, MD 20782
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Fax: 301-277-8747
E-mail: info@gypsum.org
Internet: http://www.gypsum.org

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)
1825 Michael Faraday Dr.
Reston, VA 20190
Ph: 703-435-2900
Fax: 703-435-2537
E-mail: hpva@hpva.org
Internet: http://www.hpva.org

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)
120 Wall Street, 17th Floor
New York, NY 10005
Ph: 212-248-5000
Fax: 212-248-5018
E-mail: iesna@iesna.org
Internet: http://www.iesna.org

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)
1901 North Moore Street
Arlington, VA 22209-1762
Ph: 703-525-1695
Fax: 703-528-2148
E-mail: isea@safety equipment.org
Internet: http://www.safetyequipment.org/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 Hoes Lane or 2001 L Street, NW. Suite 700
Piscataway, NJ 08855-1331 or Washington, DC 20036-4910 USA
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-6380
E-mail: onlinesupport@ieee.org or ieeeusa@ieee.org
Internet: http://www.ieee.org

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 1568
Carrollton, GA 30112
Ph: 1 800 447 3352
Fax: 1 303 397 2599
E-mail: global@ihs.com
Internet: http://www.icea.net

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)
27 N. Wacker Dr. Suite 365
Chicago, IL 60606-2800 Ph:
613-233-1510
Fax: 613-482-9436
E-mail: info@igmaonline.org
Internet: http://www.igmaonline.org

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)
4755 E. Philadelphia St.
Ontario, CA 91761
Ph: 909-472-4100
Fax: 909-472-4150
E-mail: iampo@iampo.org
Internet: www.iampo.org

INTERNATIONAL CODE COUNCIL (ICC)
5360 Workman Mill Road
Whittier, CA 90601
Ph: 1-888-422-7233
Fax: 562-908-5524
E-mail: webmaster@iccsafe.org
Internet: www.iccsafe.org

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Centre Ave. Suite 102
Portage, MI 49024
Ph: 269-488-6382
Fax: 269-488-6383
E-mail: neta@netaworld.org
Internet: http://www.netaworld.org

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
1, ch. de la Voie-Creuse
Case Postale 56
CH-1211 Geneve 20 Switzerland
Ph: 41-22-749-01-11
Fax: 41-22-733-34-30
E-mail: central@iso.ch
Internet: http://www.iso.org

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)
1899 Preston White Drive
Reston, VA 20191-5435
Ph: 703-264-1690
Fax: 703-620-6530
E-mail: info@kcma.org
Internet: http://www.kcma.org

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
127 Park Street, NE
Vienna, VA 22180
Ph: 703-281-6613
Fax: 703-281-6671
E-mail: info@mss-hq.com
Internet: http://www.mss-hq.com

MARBLE INSTITUTE OF AMERICA (MIA)
28901 Clemens Road, Suite 100
Cleveland, OH 44145
Ph: 440-250-9222
Fax: 440-250-9223
E-mail: info@marble-institute.com
Internet: http://www.marble-institute.com

MASTER PAINTERS INSTITUTE (MPI)
2800 Engleton Avenue
Burnaby, BC CANADA V5C 6G7
Ph: 604-298-7578
Fax: 604-298-7571
E-mail: info@paintinfo.com,jody@mpi.net,bgl@mpi.net

Internet: http://www.paintinfo.com/mpi

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)
1300 Sumner Avenue
Cleveland, OH 44115-2851
Ph: 216-241-7333
Fax: 216-241-0105
E-mail: mbma@mbma.com
Internet: http://www.mbma.com

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)
16712 Elm Circle
Omaha, NE 68130
Ph: 800-747-6422
Fax: 402-330-9702
E-mail: mica@tconl.com
Internet: http://www.micainsulation.org

NACE INTERNATIONAL (NACE)
1440 South Creek Drive
Houston, TX 77084-4906
Ph: 281-228-6200
Fax: 281-228-6300
E-mail: firstservice@nace.org
Internet: http://www.nace.org

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
800 Roosevelt Road, Bldg C, Suite 312
Glen Ellyn, IL 60137
Ph: 630-942-6591
Fax: 630-790-3095
E-mail: wlewis7@cox.net(Vernon Lewis,technical consultant)
Internet: http://www.naamm.org

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
3 Bethesda Metro Center, Suite 1100
Bethesda, MD 20814
Ph: 301-657-3110
Fax: 301-215-45002
Internet: http://www.necanet.org/

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209
Ph: 703-841-3200
Fax: 703-841-5900
Internet: http://www.nema.org/

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)
8575 Grovemont Circle
Gaithersburg, MD 20877
Ph: 301-977-3698
Fax: 301-977-9589
E-Mail: elana@nebb.org
Internet: http://www.nebb.org

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

6305 Ivy Lane, Suite 140
Greenbelt, MD 20770
Ph: 301-589-1776
Fax: 301-589-3884
E-Mail: info@nfrc.org
Internet: http://www.nfrc.org

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000 or 800-344-3555
Fax: 617-770-0700
E-mail: webmaster@nfpa.org
Internet: http://www.nfpa.org

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)
6830 Raleigh LaGrange Road
Memphis, TN 38184-0518
Ph: 901-377-1818
E-mail: info@nhla.com
Internet: http://www.natlhardwood.org

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
Mail Stop C-34
4676 Columbia Parkway
Cincinnati, OH 45226
Ph: 513-533-8611
Fax: 513-533-8285
E-mail: nioshdocket@cdc.gov
Internet: http://www.cdc.gov/nchs/products.htm

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)
10255 West Higgins Road, Suite 600
Rosemont, IL 60018-5607
Ph: 847-299-9070
Fax: 847-299-1183
E-mail: form available online
Internet: http://www.nrca.net

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)
272 Tuttle Road
Cumberland, ME 04021
Ph: 207-829-6901
Fax: 207-829-4293
E-mail: barbara@nelma.org
Internet: http://www.nelma.org

NSF INTERNATIONAL (NSF)
789 North Dixboro Road
P.O. Box 130140
Ann Arbor, MI 48113-0140
Ph: 734-769-8010 or 800-NSF-MARK
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E-mail: info@nsf.org
Internet: http://www.nsf.org

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

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Internet: http://www.ppfahome.org

PLUMBING AND DRAINAGE INSTITUTE (PDI)
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Fax: 978-557-0721
E-Mail: pdi@PDIonline.org Internet:

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REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)
405 Enfrente Drive, Suite 200
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Fax: 415-382-8531
E-Mail: info@calredwood.org
Internet: http://www.redwoodinspection.com/

SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION (SEFA)
1205 Franklin Avenue, Suite 320
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Ph: 516-294-5424
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E-mail: david@sefalabs.com, barbara@sefalabs.com, sefalabs@aol.com
Internet: http://www.scs1.com

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)
2200 Powell Street, Suite 725
Emeryville, CA 94608
Ph: 510-452-8000
Fax: 510-452-8001
Internet: http://www.scs1.com

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
4201 Lafayette Center Drive
Chantilly, VA 20151-1219
Ph: 703-803-2980
Fax: 703-803-3732
E-mail: info@smacna.org
Internet: http://www.smacna.org

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)
400 Commonwealth Drive
Warrendale, PA 15096-0001
Ph: 724-776-4970
Fax: 724-776-0790
E-mail: customerservice@sae.org
Internet: http://www.sae.org

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

21865 Copley Drive
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PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00

CONSTRUCTION QUALITY CONTROL AND KEY PERSONNEL

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Requirements of this Section apply to, and are component of, each section of the specifications.

1.2 DEFINITIONS

Reference to the Government COR and Construction Representative (ConRep) herein refers to the FLETC Facilities Management Division Project Manager and Construction Representative.

1.3 SUBMITTALS

Approval is required for submittals as identified by each task order. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

The below listed Pre-Construction Submittals are critical to start of work activities and are required to be provided to the Government a minimum of seven (7) calendar days prior to the scheduled kick-off Preconstruction Conference All Pre-Construction submittals require Government approval. Make any required Pre-Construction Re-Submittals within five (5) calendar days after Government rejection. Neglect to provide timely approved Pre-Construction submittals and to employ approved key on-site Project Manager, Quality Control Manager and Superintendent personnel will not be the basis for time extension, claim under the Contract, nor will it be subject to the Disputes clause. Submit four (4) submittal copies for Government retention PLUS the number of copies requested for return back to the Contractor.

Construction Quality Control (QC) Plan;

Submit a QC Plan in accordance with the requirements of this Section. Acceptance of the QC Plan is required prior to start of construction work.

Key Personnel Resumes, Qualifications, Letters of Commitment, Certificates and Appointment Letters;

Key personnel are the Contractor's: Project Manager (PM), Alternate PM, Quality Control Manager (QCM), Alternate QCM, Superintendent, and Alternate Superintendent. Alternates are held to the same standards as the primary position holders. Requirements specified herein for the primary PM, CQM, and Superintendent position holders are equally applicable to the Alternate position holders when they are serving in their designated alternate position capacity.

Upon initial solicitation key personnel were vetted and the associated skill sets considered. Should replacement personnel be deemed prudent by the Contractor, the individual replacement personnel shall have equal or greater skill set than the person they are replacing. Prior to replacement of those key positions outlined, the contractor shall submit qualifications and experience in resume format. Include: resume; letters of commitment attesting to the candidates' availability signed by an officer of the Contractor and the proposed candidates; and appointment letters signed by an officer of the Contractor for review and approval. Submit qualifications and experience information in resume format and include attachments as necessary. Include formal educational experience, copies of diplomas and training certificates, chronological work history, positions held, descriptions of duties and responsibilities, relevant project descriptions and demonstration of satisfaction of the required qualifications. Provide additional information as requested.

Submit for Government review no later than seven (7) calendar days prior to the scheduled replacement.

Acceptable key personnel qualifications, performance, and organizational observance of required PM, QCM and Superintendent authorities are considered critical to success of task orders executed under this contract. Required authorities of the PM, QCM and Superintendent are described in this Section and are to be acknowledged in the Appointment Letters. Government approval of replacement key personnel is necessary prior to assignment of the replacement.

Contractor Safety Plan;

Provide a comprehensive Safety Plan in accordance with the related Section for SAFETY REQUIREMENTS. The Safety Plan comprises, but is not limited to, an Accident Prevention Plan (APP), Activity Hazard Analysis (AHA), Health and Safety Plan, provision of proposed Safety Officer Training Records and Qualifications.

Contractor Environmental Plan;

Provide a comprehensive Environmental, Indoor Air Quality and Waste Management Plan in accordance with the related Sections for CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT and TEMPORARY ENVIRONMENTAL CONTROLS. Provide required Environmental Officer Training Records and Qualifications.

1.4 REPORTING FORMS

Use reporting forms provided in the contract or obtain a single copy of forms from the Facilities Management COR. The report forms will consist of the Superintendent's Daily Report (FTC-FMD-42) and the Quality Control Manager's Daily Report (FTC-FMD-67). Other forms shall be developed by the Contractor and submitted for approval of the Government for reporting of QC Meeting Agendas and Minutes, Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, Requests For Information (RFI), Field Test

Reports, and Testing Plan and Log. Submit electronic daily reports via email to both the Facilities Management Division. Copy the Government COR /Pm, and ConRep (if assigned).

Deliver the following to the assigned Government task order Project Manager during Construction:

a. Superintendent's and QCM's Reports: Electronically transfer completed and signed daily reports to the Facilities Management Division assigned Project Manager and Contracting Officer by 10:00 AM the next working day. Provide daily reports for all working and non-working days through the date of final acceptance of all work. Annotate non-working days accordingly on reports.

b. Preparatory Phase Checklist: Original attached to the original QCM Report and one copy attached to each QCM Report copy.

c. Initial Phase Checklist: Original attached to the original QCM Report and one copy attached to each QCM Report copy.

d. Field Test Reports: Hand-carry the original within two working days after the test is performed, attached to the original QCM Report and one copy attached to each QCM Report copy.

1.5 KEY PERSONNEL AND QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. This QC program is a key element in meeting all project objectives of timely and quality performance. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), QC meetings, three phases of control, submittal review and approval, testing, completion inspections, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No construction work or testing may be performed without an approved Quality Control Manager AND Superintendent being physically present on the FLETC premises. Duties requiring departure from the site during any work activities shall be performed by personnel other than the QC Manager and Superintendent. Absence of these key personnel or their approved alternates from the FLETC premises during work activities can result in work stoppage, contract price reduction, staffing removal, and/or other actions as determined by the Government. The QC Manager shall report to an Officer of the firm and shall not be subordinate to the field Project Manager or Superintendent. The QC Manager, PM and Superintendent must work together effectively. Although the QC Manager is the primary individual responsible for quality control, the PM and Superintendent are accountable for the quality of work produced under their supervision. The Contractor shall maintain a competent approved PM, QCM and Superintendent at the FLETC premises at all times work is being performed.

Designated Alternate key personnel must be available on-site in the event of absence of the primary key person(s).

1.5.1 Commissioning

Commissioning (Cx) is a systematic process of ensuring that all building systems meet the requirements and perform interactively according to the Contract. The QC Program is a key to this process by coordinating, verifying and documenting measures to achieve the following objectives:

a. Verify and document that the applicable equipment and systems are installed in accordance with the design intent as expressed through the Contract and according to the manufacturer's recommendations and industry accepted minimum standards.

b. Verify and document that equipment and systems receive complete operational checkout by the installing contractors.

c. Verify and document proper performance of equipment and systems.

d. Verify that Operation and Maintenance (O&M) documentation is complete.

e. Verify and document that the Government's operating personnel are adequately trained.

1.5.2 Acceptance of the Construction Quality Control (QC) Plan and Key Personnel

Acceptance of the QC Plan is required prior to the start of construction activities. The Government reserves the right to require changes in the QC Plan and operations as necessary. The Government reserves the right to interview any personnel at any time in order to evaluate and verify personnel qualifications and a suitable level of work performance. The PM, Superintendent and QCM organization personnel shall be subject to acceptance by the COR. If at any time during the Contract performance period, should key personnel's job performance fall below a reasonable standard of competence, professionalism, attendance, or should performance be otherwise objectionable, he/she shall be promptly replaced by the Contractor upon request from the Government. Neglect to maintain an effective Quality Control Program and acceptable key Quality Control and Superintendent Personnel will not be the basis for claim under the Contract nor will it be subject to the Disputes clause. All persons are subject to a background criminal investigation at the discretion of the Federal Law Enforcement Training Center.

1.5.3 Notification of Changes

Notify the COR/PM, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel, a minimum of 10 work days prior to a proposed change. Proposed changes shall be subject to acceptance by the COR. Notify the COR in advance when the Alternate PM, QCM or Superintendent will temporarily assume duties as necessitated by an absence of the primary person(s).

1.6 CONTRACTOR KEY PERSONNEL

All key personnel shall be direct employees of the prime Contractor and shall be on-site on normal working days at least between the Normal hours of 7:30 a.m. and 4:30 p.m. At a minimum, one (1) of the key personnel (Project Manager, Project Superintendent, QC Manager and alternates, if

applicable) must always be onsite during Normal hours.

1.6.1 Quality Control Manager (QCM)

1.6.1.1 Duties

Provide an on-site QC Manager to implement and manage the QC program. The QC Manager shall devote his time exclusively to work under this contract only. The QC Manager shall devote his time exclusively to the work under this contract only and shall be on-site at least on normal working days between the Normal hours of 7:30 a.m. and 4:30 p.m. The QC Manager shall: administer the three phases of quality control, have the authority to stop work, require work replacement, direct subcontractor performance with regard to quality, issue and enforce Contractor non-compliance notices with respect to all work. The QC Manager shall not be designated as the safety competent person as defined by the adopted U.S. Army Corps of Engineers (USACE) Safety Manual EM 385-1-1. The QC Manager is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meeting, Progress Meetings, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of quality control and documentation performed by testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

1.6.1.2 QC Manager Qualifications

As a minimum, the individual shall demonstrate completion of High School level education. The individual shall possess a total cumulative minimum of ten (10) years combined experience on similar private or Federal construction projects in the following positions: Project Superintendent, QC Manager, Project Manager, or Construction Manager. Of this cumulative experience, at least five years' experience shall be as a QC Manager on similar United States Military or Federal agency construction contract. Similar construction contracts are defined to be of comparable cost, type and complexity of work and including the major trades that are part of this Contract. The individual shall be experienced with Federal administrative construction processes. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). In addition to the above experience and education requirements, the QC Manager shall have completed the course entitled "Construction Quality Management (CQM) for Contractors." If the QC Manager does not have a current certification, he/she shall obtain the CQM for Contractors course certification within 30 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact these organizations for information on the next scheduled class. The individual must be familiar with the safety requirements of USACE EM 385-1-1 and/or OSHA 1926 Construction and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, Outlook (e-mail). The individual must demonstrate a working

knowledge and familiarity with Critical Path Network scheduling and be familiar with MS Project or similar project management software.

1.6.1.3 Alternate QC Manager Duties and Qualifications

The Government approved and authorized alternate QC Manager shall be available on-site to serve in the event of the designated primary QC Manager's absence. The Alternate QC Manager Qualifications shall be the same the QC Manager's.

1.6.2 Superintendent

1.6.2.1 Duties

The Contractor shall employ, on-site at the project location, a full time Superintendent who shall be subject to approval by the Government prior to Notice to proceed being given. The Superintendent shall devote his time exclusively to the supervision of work under this contract only and shall be on-site at least on normal working days between the Normal hours of 7:30 a.m. and 4:30 p.m. and at all times during the active performance of construction activities. The Superintendent is not to self-perform work activities. The Superintendent shares a high level of responsibility for management and production of timely and quality conforming work. The Superintendent shall have the authority to act for the Contractor with the same force and effect of the project manager. There may be multiple job sites with work in progress at the same time. The Superintendent shall visit each site a minimum of once a day when work is being performed, supervise and monitor work performance and accurately report activities in daily reports.
Autonomy of the on-site superintendent is critical to the smooth operation of FLETC requirements.

The QC Management organization is not subordinate to the Superintendent. An Appointment Letter delegating these authorities shall be signed by a Principle Officer of the firm and submitted to the COR along with the Superintendent's resume for approval. The Superintendent is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meeting, and conduct Progress Meetings. The Superintendent will conduct frequent and routine meetings with Contractor and Subcontractor personnel to: coordinate trade work performance, review schedule objectives for definable features of work, coordinate work conformance to approved submittals, plan and sequence the orderly progress of trade work, correct work deficiencies, maintain job site safety, address material and equipment delivery and proper storage, ensure environmental compliance, ensure testing is satisfactorily, and conduct other related supervisory duties as necessary. The Superintendent may be designated as the safety competent person as defined by the adopted U.S. Army Corps of Engineers (USACE) Safety Manual EM 385-1-1. Computer proficiency is required in such software systems as Word, Excel, Outlook (e-mail) and MS Project/Primavera. The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling.

1.6.2.2 Superintendent Qualifications

An individual with a minimum of fifteen (10) years combined experience in the following positions: Project Superintendent, QC Manager, Project Manager, or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract

The individual shall have at least five (5) years of experience as a Superintendent on similar size, complexity and type contracts. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail).

The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.2.3 Alternate Superintendent Duties and Qualifications

The Government approved and authorized alternate Superintendent shall be available on-site to serve in the event of the designated primary Superintendent’s absence. The Alternate Superintendent's duties and qualifications shall be the same as the Superintendent's

The individual shall have at least five (5) years of experience as a Superintendent on similar size, complexity and type contracts. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail).

The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.2.4 Alternate Superintendent Duties and Qualifications

The Government approved and authorized alternate Superintendent shall be available on-site to serve in the event of the designated primary Superintendent's absence. The Alternate Superintendent's duties and qualifications shall be the same as the Superintendent's.

1.6.3 Project Manager

1.6.3.1 Duties

The Contractor shall employ a Project Manager, subject to approval by the Government prior to Notice to Proceed being given. The Project Manager shall devote his time exclusively to this contract and shall be on-site on normal working days at least between the Normal hours of 7:30 a.m. and 4:30 p.m. The PM will be the Government's primary point of contact for this contract. PM is also responsible for day-to-day task order management and administration. The PM is not to self-perform work activities. The PM shares a high level of responsibility for management and production of timely and quality conforming work. The QC Management organization is not subordinate to the PM. The PM shall be delegated authority by the Contractor to sign contract modifications, negotiate and reach agreement for the Contractor on matters such as change orders, time extensions, and other issues arising under the contract which may lead to contract modification in accordance with FAR 52- 236-6. An Appointment Letter delegating these authorities shall be signed by a Principle Officer of the firm and submitted to the Government. An original signature copy of this delegation of authority shall be provided to the Contracting Officer with the Project Manager's resume. The PM is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meetings, and Progress Meetings.

1.6.3.2 PM Qualifications

An individual with a minimum of fifteen (10) years combined experience in the following positions: Project Manager, Project Superintendent, QC Manager, or Construction Manager with the last five (5) years' experience as a Project Manager on specific IDIQ, SABER, or JOC contracts within the minimum range of at $3M or above, with a performance period of

more than one year. The Project Manager must have been employed directly by the prime contractor and served in that capacity for the duration of the contract. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail). The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.3.3 Alternate PM Duties and Qualifications

The Government approved and authorized alternate Project Manager shall be available on-site to serve in the event of the designated primary Project Manager's absence. The Alternate PM's duties and qualifications shall be the same as the Project Manager's.

1.6.4 Key Personnel Resume Requirements

1.6.4.1 Acceptable key personnel qualifications, performance, and organizational observance of required authorities are considered critical to the project.

1.6.4.2 Offeror's shall initially submit their proposed primary and alternate key personnel resumes and letters with the technical proposal during the contract solicitation phase. Submit primary and alternate Key Personnel resumes and letters as described in paragraph 1.3 Key Personnel Resumes, Qualifications, Letters of Commitment, Certificates and Appointment Letters; Any approvals of proposed key personnel are contingent upon the Government's review and approval of key personnel and satisfactory background investigations. Award of a contract does not imply acceptance of the proposed key personnel. Acceptance occurs post-award.

1.6.4.3 Post-award and a minimum of seven (7) calendar days prior to the scheduled Preconstruction Conference, the Contractor shall again submit the documents required by paragraph 1.3 for formal Government review and approval of all key personnel. Submission of resumes failing to demonstrate compliant qualifications will be rejected.

1.6.4.4 Any subsequent proposed change in key personnel requires submission of the resume and other documents for Government review and approval.

1.6.5 Commissioning Authority

1.6.5.1 Duties

If required by a task order, provide a Commissioning Authority (CA) as key

person for the commissioning (Cx) and documentation thereof, who is subordinate to the QC Manager. The CA shall direct and coordinate Cx activities and submit Cx reports to the COR to meet the submittal and reporting requirements of Commissioning. The CA shall coordinate the actions of the QC Specialists, Testing Laboratory personnel, and other inspection and testing personnel required by this Contract for building Cx.

1.6.5.2 Qualifications

The CA must be certified as a commissioning professional by the Association of Energy Engineers (AEE), the Building Commissioning Association (BCA), the National Environmental Balancing Bureau (NEBB). CA resume is required, providing education, experience and management capabilities on at least two similar size and type contracts. The CA may not have been involved with the project design, construction management, or supervision, and must be with a third-party firm that is not on the design team.

1.7 QUALITY CONTROL (QC) PLAN

1.7.1 Construction Quality Control (QC) Plan

1.7.1.1 Requirements

A QC Plan shall be submitted for review and approval a minimum of seven (7) calendar days prior to the scheduled Preconstruction Conference. Provide, for acceptance by the COR, a Construction QC Plan submitted in a three-ring binder that includes a table of contents, with major sections identified with tabs as listed below, with pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing commissioning activities during the construction of the project. The Contractor is responsible to incorporate any review comments into the Final Plan and obtaining Government approval of the Plan prior to start of work activities as described by the paragraph "Acceptance of the Construction Quality Control Plan".

I. QC ORGANIZATION: A chart showing the QC organizational structure.

II. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format as described by the paragraph "Key Personnel Resume Requirements", for each person in the QC organization. Include all supporting documents demonstrating compliance with the stated qualifications to include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "QC Manager Qualifications".

III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

V. APPOINTMENT LETTERS: Letters signed by a principle officer of the firm appointing the PM, QC Manager, Superintendent, Alternate PM, Alternate QCM and Alternate Superintendent describing and delegating the required duties and authorities required in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work which is not in compliance with the Contract. The QC Manager shall issue letters of direction to all other QC personnel outlining their duties, authorities, and responsibilities. Copies of the letters shall be included in the QC Plan.

VI. SUBMITTAL PROCEDURES: Procedures for reviewing, approving, and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.

VII. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs entitled "Accreditation Requirements", as applicable.

VIII. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, document corrective action plans and complete rework items. Include proposed forms to record and track rework items.

IX. DOCUMENTATION PROCEDURES: Include proposed forms and provide copies of the Government furnished QCM and Superintendent daily report forms.

X. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures you will use to ensure the three phases of control are used to manage the quality on this project.

XI. ORGANIZATIONAL MATRIX: A matrix showing organizational structure and hierarchal relationships of key field staff and home office management.

XII. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.

XIII. TRAINING PROCEDURES AND TRAINING LOG: Procedures for coordinating and documenting the training of personnel required by the Contract.

XIV. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

1.8 QC PLAN MEETINGS

The QC Manager will meet with the COR to discuss the QC Plan requirements of this Contract as required.

1.9 COORDINATION AND MUTUAL UNDERSTANDING MEETINGS

After submission of the QC Plan, and prior to the start of construction work, the QCM will meet with the COR to present the QC program required by this Contract. When a new QC Manager is appointed, the coordination and mutual understanding meeting shall be repeated.

1.9.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how three phases of control will be implemented.

a. Waste Management Plan.

b. Indoor Air Quality (IAQ) Management Plan.

c. Procedures for noise and acoustics management.

d. Environmental Protection Plan.

e. Environmental regulatory requirements.

f. Commissioning (Cx) Plan.

1.9.2 Coordination of Activities

Activities included in various sections shall be coordinated to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation. Schedule construction operations with consideration for indoor air quality as specified in the IAQ Management Plan.

1.9.3 Attendees

As a minimum, the Contractor's personnel required to attend shall include PM, Superintendent, and QC Manager. The Contractor shall provide a copy of the signed minutes to all attendees and a copy shall be included in the Final QC Plan.

1.10 QC MEETINGS

After the start of construction, the QC Manager shall conduct routine QC meetings at the field office with the PM, Superintendent, and the subcontractor foremen. The QC Manager shall prepare the minutes of the meeting and provide a copy to the COR within two working days after the meeting. Government personnel may attend these meetings. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work and rework;

c. Review the status of submittals;

d. Review work and testing accomplished since the last meeting;

e. Address rework items identified since the last meeting;

f. Address rework items corrected since the last meeting;

g. Review the work to be accomplished in the next two weeks and documentation required;

h. Resolve QC and production problems (RFI, etc.);

i. Address items that may require revising the QC Plan;

j. Review Accident Prevention Plan (APP);

k. Review environmental requirements and procedures;

l. Review Waste Management Plan;

m. Review IAQ Management Plan;

n. Review Environmental Management Plan;

o. Review the status of training completion; and

p. Review commissioning (Cx) Plan and progress, if applicable.

1.11 DESIGN REVIEW AND DOCUMENTATION

1.11.1 Design Review

If applicable, the CA shall review design documents to verify that each commissioned system meets the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. Fully document review in written report.

1.11.2 Contract Document Review

The CA shall review the Contract documents to verify that each commissioned system is likely to meet the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts.

1.12 THREE PHASES OF CONTROL

The Three Phases of Control shall adequately cover both on-site and off-site work and shall include the following.

1.12.1 Preparatory Phase

Notify the Government PM at least two work days in advance of each preparatory phase meeting. The meeting shall be conducted by the QC Manager and attended by the Project Superintendent and the foreman responsible for the Definable Feature of Work (DFOW). When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman shall attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFOW:

a. Review each paragraph of the applicable specification sections;

b. Review the Contract drawings;

c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders in order to coordinate work and avoid dimensional errors and rework;

d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;

e. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

f. Examine the work area to ensure that the required preliminary work has been completed;

g. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials;

h. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

i. Discuss construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW;

j. Review the Accident Prevention Plan (APP) and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

k. If applicable, review the Commissioning (Cx) Plan and ensure all preliminary work items have been completed and documented.

1.12.2 Initial Phase

Notify the Government PM at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the Project Superintendent, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the

results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each DFOW:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Ensure that testing is performed by the approved laboratory;

d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met; and

e. If applicable, review the Cx Plan and ensure all preparatory work items have been completed and documented.

1.12.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report:

a. Ensure the work is in compliance with Contract requirements;

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed by the approved laboratory;

d. Ensure that rework items are being corrected;

e. Perform safety inspections; and

f. If applicable, review the Cx Plan and ensure all work items, testing, and documentation has been completed.

1.12.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

1.13 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES. Submittals requiring Government approval will be identified by each task order and are to be scheduled and made prior to the acquisition of the material or equipment covered thereby. Submittals not requiring Government approval will be approved by the Quality Control Manager and made available to the Government if requested for information only. All submittals shall be reviewed and certified compliant by the QCM.

1.14 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.14.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.14.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at http://ts.nist.gov/ts/htdocs/210/214/214.htm, the American Association of State Highway and Transportation Officials (AASHTO) program at http://www.transportation.org/aashto/home.nsf/frontpage, International Accreditation Services, Inc. (IAS) at http://www.iasonline.org, U. S. Army Corps of Engineers Materials Testing Center (MTC) at http://www.wes.army.mil/SL/MTC/, the American Association for Laboratory Accreditation (A2LA) program at http://www.a2la.org/, the Washington Association of Building Officials (WABO) at http://www.wabo.org/.

1.14.3 Capability Check

The Government retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.14.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Project Manager immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Within five (5) days of testing, furnish the signed reports, certifications, and other documentation to the Project Manager via the QC Manager and the Daily QC Report. Full payment for work subject to testing is dependent upon successful testing.

1.15 QC CERTIFICATIONS

1.15.1 CQC Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.15.2 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Government attesting that "the work has been completed, inspected, tested and is in compliance with the Contract."

1.16 COMPLETION INSPECTIONS

1.16.1 Punch-Out Inspection

Near the completion of all work on a task order or any increment thereof, established by a completion time stated in the task order, the QC Manager shall self-perform an inspection of the work and develop a "punch list" of items which do not conform to the contract documents. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch-Out Inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. Four copies of the punch list shall be provided to the Government. The QC Manager shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall certify in writing to the Government that Punch-Out work is satisfactorily completed and the facility is ready for the Government "Pre-Final Inspection". Allow a minimum of two (2) working days for Government coordination of the start of Pre-Final Inspection.

1.16.2 Pre-Final Inspection

The Government will perform this inspection to verify that the task order is complete. The Government may terminate Pre-Final Inspection at any time should it be determined the work has not been satisfactorily completed or that previously documented deficiencies remain incomplete. In such an instance the Contractor shall resume and progress Punch-Out work and the QCM shall repeat the Punch-Out Inspection. A Government "Pre-Final Punch List" may be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the Client can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner and shall be accomplished before the task order completion date for the work, or any particular increment thereof, if the project is divided into increments by separate completion dates.

1.16.3 Final Acceptance Inspection

The QCM shall coordinate with the Government PM the date a task order final acceptance inspection can be held. The notice shall certify in writing that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the proposed date of the final acceptance inspection. The Contractor shall be represented by the QC Manager, Superintendent, the CA if applicable, and

others deemed necessary. Attendees for the Government may include the Project Manager, COR, and personnel representing the Client.

1.17 TRAINING

Prior to request for "Pre-final Inspection" of a task order by the QC Manager, provide Government personnel training for the systems and equipment if specified by a task order. The trainees shall include the Government's Project Manager, ConRep, facilities managers, maintenance staff, and key building occupants. The Contractor shall be responsible for coordinating, scheduling, and ensuring that training is completed. Instructors shall have a working knowledge and be well-versed in the particular systems that they are presenting. Provide instruction time on site at a location approved by the Government Project Manager.

1.17.1 Content

Training shall stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The core of this training will be based on manufacturer's recommendations and the operation and maintenance information provided as a part of this Contract. A review of environmentally-related aspects of the Operation and Maintenance Manuals shall be included. The following shall be included for each system:

a. Design intent based on the contract documents.

b. Use of O&M Manuals.

c. Review of control drawings and schematics.

d. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

e. Interactions with other systems.

f. Adjustments and optimizing methods for energy conservation.

g. Relevant health and safety issues.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

j. Discussion of how the feature or system is environmentally responsive.

1.17.2 Building Systems Training

The QCM shall be responsible for coordination of all building systems training with the Government. Prior to Punch-Out of a task order, provide the Government Project Manager a comprehensive listing of the building systems training and the proposed training schedule for each course. Training course schedules are subject to Government coordination and

approval. The Contractor will provide each trainee in the course a written course outline and training manual, listing the major and minor topics to be discussed by the instructor on each day of the course. Assume a maximum of ten (10) trainees in any single system course of training. The QCM shall record training minutes and a sign-in list containing attendees' names/organizations. Submit to the Government Project Manager a record of training agendas, minutes, and attendees within five (5) calendar days of completion of each training course.

1.18 DOCUMENTATION

1.18.1 Construction Documentation

Reports are required for each day that work is performed and shall accompany the Contractor Quality Control Daily Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign their respective daily reports. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.18.2 Quality Control Field Office Library

Establish and maintain the following library of information at the site Contractor field office in a series of separate three ring binders. Binders shall be identified, divided and tabbed for the orderly presentation of information. These binders shall be maintained, readily and publicly accessible in the field office to Government personnel during all business hours.

a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.

b. All milestone inspections.

c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.

d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

e. An up-to-date copy of the Rework Items List and the related Corrective Action Plans.

f. Maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the Government.

g. Commissioning documentation including Cx checklists, schedules, tests, and reports.

h. Training Log, training agendas, attendees list, training manuals, training verification forms and other supporting documentation.

i. Copies of Field Change and Variance Logs arranged numerically in a chronological order recording all Government approved field changes and variances. Use the Government approved form for Variances. Include description of the subject specification or drawing reference, related correspondence and documents, and documentation of Field Change or Variance approval from the Project Manager.

j. Testing Plan and Log including all test reports and approvals organized and tabbed by specification section.

k. Request For Information (RFI) Log including copies of all RFI's and the responses arranged in a numerical order.

l. Submittal Log including a comprehensive listing of all submittals required by the contract documents with delivery dates and actions taken. Organize and tab by specification section.

m. Contractor Construction Compliance Notice (CCCN) Log including copies of all original signed compliance notices arranged in numerical order. Include descriptions of problems, corrective actions, and dates of correction completion.

o. Listing of all Subcontractors and emergency contact information for each.

1.18.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Government Project Manager. Attach a copy of the updated "Testing Plan and Log" to the Daily CQC Report.

1.18.4 Rework Items List and Corrective Action Plans

The QC Manager shall maintain a list of work that does not comply, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. Provide detailed written Corrective Action Plans to the Government Project Manager as requested in association with rework items. Corrective action plans shall be presented in narrative format with supporting drawings, product information, submittals, and other documents as required. Do not progress work without written Government Project Manager approval of Corrective Action Plans. Make changes to Corrective Action Plans as required by the Government. Remove and replace non-compliant or deficient work as instructed. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to each Progress Meeting Agenda and to the last daily

CQC Report of each month. The Contractor shall be responsible for including those items identified by the Government.

1.18.5 As-Built Drawings

The QC Manager is required to ensure the as-built drawings, if required, are kept current on a daily basis and marked to show deviations which have been made from the task order drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. Field Change No., Variance No., Modification No., Request for Information No., etc.). The QC Manager shall initial each revision.

1.19 NOTIFICATION OF NON-COMPLIANCE

The Government will notify the Contractor of detected non-compliance with the Contract. Such notice, when verbally delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. The Government may, at its discretion, issue Construction Contractor Compliance Notices (CNNN's) or other written documentation concerning a non-complaint work. The Contractor shall take immediate steps to bring work into compliance. When a Corrective Action Plan is required by the Government, no corrective work shall occur prior to Government Project Manager approval of the Corrective Action Plan. If the Contractor fails or refuses to promptly bring work into compliance, the Government may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time for excess costs or damages by the Contractor.

1.20 CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

An IAQ Management Plan shall be submitted not less than 10 days before the Preconstruction Conference. Revise and resubmit Plan as required by the Government. Copies of the final Plan shall be made available to all workers on site. Include provisions in the Plan to meet the requirements specified below and to ensure safe, healthy air for construction workers and building occupants.

1.20.1 Requirements During Construction

Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D 6245. Provide for evaluation of volatile organic compounds (VOCs) in indoor air in accordance with ASTM D 6345. Use filters with a Minimum Efficiency Reporting Value (MERV) of 8 in permanently installed air handlers during construction.

1.20.1.1 Control Measures

The Contractor shall meet or exceed the requirements of SMACNA 1507, Chapter 3, to help minimize contamination of the building from construction activities. The five requirements of this manual which must be adhered to are described below:

a. HVAC protection: Isolate return side of HVAC system from surrounding environment to prevent construction dust and debris from entering the duct work and spaces.

b. Source control: Use low emitting paints and other finishes, sealants, adhesives, and other materials as specified. When available, cleaning products shall have a low VOC content and be non-toxic to minimize building contamination. Utilize cleaning techniques that minimize dust generation. Cycle equipment off when not needed. Prohibit idling motor vehicles where emissions could be drawn into building. Designate receiving/storage areas for incoming material that minimize IAQ impacts.

c. Pathway interruption: When pollutants are generated use strategies such as 100 percent outside air ventilation or erection of physical barriers between work and non-work areas to prevent contamination.

d. Housekeeping: Clean daily to remove construction dust and debris. Promptly clean up spills. Remove accumulated water and keep work areas dry to discourage the growth of mold and bacteria. Take extra measures when hazardous materials are involved.

e. Scheduling: Control the sequence of construction to minimize the absorption of VOCs by other building materials.

1.20.1.2 Moisture Contamination

a. Remove accumulated water and keep work dry.

b. Use dehumidification to remove moist, humid air from a work area.

c. Do not use combustion heaters or generators inside the building.

d. Protect porous materials from exposure to moisture.

e. Remove from the site and replace water damaged items as directed by the Project Manager.

1.20.2 Requirements After Construction

After construction ends, replace HVAC filtration media.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

3.2 GOVERNMENT QUALITY ASSURANCE

In accordance with FAR 52.246-12, Inspection of Construction:

a. Government inspections and tests are for the sole benefit of the Government and do not-

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;
(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;
(3) Constitute or imply acceptance; or
(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

b. The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the task order specification.

c. The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Project Manager. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work.

d. The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

e. If the Contractor does not promptly replace or correct rejected work, the Government may-

(1) By contract or otherwise, replace or correct the work and charge the cost to the Contractor; or
(2) Terminate for default the Contractor's right to proceed.

f. If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Government shall make an equitable adjustment for the additional services involved in the examination and

reconstruction, including, if completion of the work was thereby delayed, an extension of time.

3.3 GOVERNMENT ACCEPTANCE

The performance and quality of work delivered by the Contractor, including services rendered and any documentation, shall be subject to inspection, review, and acceptance by the Government. All work shall be completed within the time specified in the contract, including provision of close-out documents and correction of deficiencies noted during the final inspection.

3.4 WARRANTY RESPONSIBILITIES

The Contractor shall perform quality control duties in relation to warranty work. Provide a knowledgeable and competent person on site to coordinate, supervise, and to execute quality control processes on warranty work. Perform final inspection of warranty work and promptly notify the Government of the compliant completion of warranty work. Responses times and corrective actions shall be coordinated with the Government. In accordance with FAR 52.246-21 Warranty of Construction:

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under each task order conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of 1 year from the date of final acceptance of the work in each task order. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of-

(1) The Contractor's failure to conform to contract requirements; or
(2) Any defect of equipment, material, workmanship, or design furnished.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

e. The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government

shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall-

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

h. This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2007) Standard for Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2009) Standard for Safeguarding Construction,Alteration, and Demolition Operations
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation. Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

Backflow preventers; G

Construction Site Plan; G

SD-02 Shop Drawings

Traffic control plan; G

SD-06 Test Reports

Backflow Preventer Tests; G

SD-07 Certificates

Backflow Tester Certification; G

Backflow Preventers Certificate of Full Approval

1.4 TEMPORARY UTILITIES

1.4.1 Description of Work

Furnish, install and maintain temporary utilities required for construction. Remove on completion of work.

1.4.1.1 Requirements of Regulatory Agencies

Comply with:

a. National Electrical Code.

b. Federal, State and local codes and regulations.

c. FLETC Utility requirements

1.4.2 Materials

May be new or used, but must be adequate in capacity for the required usage. Must not create unsafe conditions. Must not violate requirements of applicable codes and standards.

1.4.2.1 Temporary Electricity

Temporary power will be extended from Government's existing power system. The Contractor will make all extensions and bear all related costs including the temporary pole and its placement. The temporary pole placement must be coordinated with Georgia Power and the Government. If the Contractor requires a temporary power drop from Georgia Power, he shall arrange for service and bear all related costs.

1.4.2.2 Temporary Telephone Service

Arrange with local telephone service company. Provide direct line telephone service at the construction site for the use of personnel and employees. Service required shall include one direct line instrument in field office and other instruments at the option of the Contractor. Pay all costs for installation, maintenance, and removal and service charges.

1.4.2.3 Temporary Water

Coordinate with the utility owner and make connections to the existing water system. The Contractor will obtain permits, pay for all temporary extensions and bear all related costs.

1.4.2.4 Temporary Toilet Facilities

Provide sanitary facilities in compliance with laws and regulations of the State of Georgia and County of Glynn. Service, clean, and maintain facilities and enclosures.

1.4.3 Installation

Comply with applicable requirements specified in Division 22 and 23 - Plumbing and Mechanical and in Division 26 - Electrical. Maintain and operate systems to ensure continuous service. Modify and extend service systems as work progress requires.

1.5 WEATHER PROTECTION

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

1.5.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

1.5.1.1 Hurricane Condition of Readiness

Unless directed otherwise, comply with:

a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards. Contact COTR for Condition Requirements.

b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment.Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness. Contact COTR for weather and COR updates and completion of required actions.

c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours):Curtail or cease routine activities until securing operation is complete.Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact COTR for weather and Condition of Readiness (COR) updates and completion of required actions.

d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

1.6 STATION OPERATION AFFECT ON CONTRACTOR OPERATIONS

1.6.1 Restricted Access Areas

The Government will monitor work in areas indicated. Notify Contracting Officer at least 14 calendar days prior to starting work in these areas.

1.6.2 Special Restrictions Regarding Access of Vehicles and Parking

1.6.2.1 Interruption of Vehicular Traffic

If during the performance of work, it becomes necessary to modify vehicular traffic patterns at any locations, notify the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan shall be in accordance with State and local regulations. Provide cones, signs, barricades, lights, signal men, or other traffic control devices and personnel required to control traffic. During construction, all traffic interruptions must be scheduled to minimize affects on staff and students. To minimize interruptions to staff and students, at the discretion of the Government, the closures may be required to occur during nonworking hours and/or weekends. Overtime and/or weekend work shall be at the expense of the Contractor.

1.7 STORAGE AREAS

Contractor shall be responsible for security of his property. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

1.7.1 Storage Size and Location

The open site available for storage shall be as indicated.

1.7.2 Storage in Existing Buildings

The Contractor shall be working around existing buildings; the storage of material will be allowed where indicated. Provide 8 foot high security fence with a lockable gate around the storage area. Remove at the completion of work and return existing facilities to their original condition.

1.8 TEMPORARY SANITARY FACILITIES

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required and approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance. Coordinate with the utility provider as required and dispose of sewage through connection to a municipal, district, or station sanitary sewage system. Bear all related costs of sanitary connections and facilities. Where such systems are not available, use chemical toilets or comparably effective units, and

periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Include provisions for pest control and elimination of odors.

1.9 TEMPORARY BUILDINGS

Temporary facilities (including trailers) shall be in like new condition. Locate these facilities where directed and within the indicated operations area. Storage of material/debris under such facilities is prohibited. Contractor shall be responsible for the security of the stored property.

1.9.1 Trailers or Storage Buildings

Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Government.The trailers or buildings shall be in good condition, free from visible damage rust and deterioration, and meet all applicable safety requirements. Trailers shall be roadworthy and comply with all appropriate state and local vehicle requirements. Failure to maintain storage trailers or buildings to these standards shall result in the removal of non-complying units at the Contractor's expense. A sign not smaller than 24 by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state of local standards for anchoring mobile trailers.

PART 2 PRODUCTS

2.1 BACKFLOW PREVENTERS

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound flanged cast iron, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. Approved backflow preventers shall be installed at all temporary connections to public fire hydrants.

PART 3 EXECUTION

3.1 TEMPORARY PHYSICAL CONTROLS

3.1.1 Access Controls

3.1.1.1 Temporary Barricades

Contractor shall provide for barricading around all work areas to prevent public access.

3.1.1.2 Fencing

The fencing shall be chain link and be 8 feet in height and be placed around the perimeter of the construction site and laydown area, and likewise a plastic silt fence shall be placed around construction site and laydown area. Fencing shall be provided along the construction site at all open excavations and tunnels controlling access to unauthorized people.

Fencing must be installed to be able to restrain a force of at least 200 pounds against it.

In addition, prior to the start of work, enclose those areas at the construction site which are not within the construction fence with a temporary safety fence, including gates and warning signs, to protect the public from construction activities. The safety fence shall be made of high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on minimum 10 foot centers. Remove the fence from the work site and restore to original condition upon completion of the contract.

3.1.1.3 Safety Signs

Place warning signs at the construction area perimeter designating the presence of construction hazards requiring unauthorized persons to keep out. Signs must be placed on all sides of the project, with at least one sign every 300 feet. All points of entry shall have signs designating the construction site as a hard hat area. Erect signs upon start of construction work.

3.2 TEMPORARY WIRING

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Program shall include frequent inspection of all equipment and apparatus.

3.3 CONSTRUCTION SIGN

Provide a 4 feet by 8 feet marine grade plywood project construction sign as described by the drawings in this section. Include project information on the sign and locate the sign as instructed by the PM. Erect project sign within 15 days of Notice to Proceed. Remove and dispose upon project completion.

-- End of Section --

SECTION 01 52 50

SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Requirements of this Section apply to, and are component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.14	(1991) Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.94	Ventilation
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.502(f)	Warning Line Systems

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	(2003) Safety and Health Requirements Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2004) Safeguarding Construction,Alteration, and Demolition Operations

1.3 DEFINITIONS

a. Multi-employer work site (MEWS). The prime contractor is the "controlling authority" for all work site safety and health of the subcontractors.

b. Recordable Occupational Injuries or Illness. An occupational injury or illnesses which result in serious injuries, lost workday cases, non-fatal cases or significant mishaps.

c. Serious Injuries & Fatalities. Regardless of the time between the injury and death or the length of the illness; hospitalization of three or more employees; or property damage in excess of $200,000.

d. Lost Workday Cases. Injuries, other than fatalities, that result in lost workdays.

e. Non-Fatal Cases. Cases without lost workdays which result in transfer to another job or termination of employment, or require medical treatment (other than first aid) or involve property damage in excess of $10,000 but less than $200,000 or involve: loss of consciousness or restriction of work or motion. This category also includes any diagnosed occupational illnesses which are reported to the employer but are not classified as facilities or lost workday cases.

f. Health and Safety Plan. Army term of SHP or SSHP used in COE EM-385-1-1. "USACE" property and equipment specified in COE EM-385-1-1 should be interpreted as Government property and equipment.

g. Safety Officer. The superintendent or other qualified or competent person who is responsible for the on-site safety required for the project. The Contractor Quality Control Manager cannot be the safety officer, even through the QC has safety inspection responsibilities as part of the QC duties.

h. Significant Contractor Mishap. A contractor mishap which involves falls of 4 feet or more, electrical mishaps, confined space mishaps, diving mishaps, equipment mishaps, and fire mishaps which result in a lost time injury, or property damage of $10,000 or more, but less than $200,000; or when fire department or emergency medical treatment (EMT) assistance is required.

i. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment provided by a physician or registered personnel.

j. First Aid. A one-time treatment, and follow-up visit for the purpose of observation, of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care, even though provided by a physician or registered professional personnel.

k. Lost Workdays. The number of days (consecutive or not) after, but not including, the day of injury or illness during which the employee would have worked but could not do so; that is, could not perform all or part of his normal assignment during all or any part of the workday or shift; because of the occupational injury or illness.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00, "Submittal Procedures."

SD-07 Certificates

Accident prevention plan (APP);

Health and Safety Plan;

The above must be submitted a minimum of 7 days prior to scheduled Preconstruction Conference. Government approval is required prior to Notice to Proceed and commencement of construction work activities.

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

a. Qualifications of Safety Officer:

(1) Ability to manage the on-site contractor safety program through appropriate management controls,

(2) Ability to identify hazards and have the capability to expend resources necessary to abate the hazards.

(3) Must have worked on similar types of projects that are equal to or exceed the scope of the project assigned with the same responsibilities.

b. Qualification of Crane Operators. Crane operators shall meet the requirements in COE EM-385-1-1, Appendix G.

1.5.2 Meetings

1.5.2.1 Preconstruction Conference

The safety officer shall attend the preconstruction conference and routine progress meetings.

1.5.2.2 Meeting on Work Procedures

Meet with employees regularly to discuss work procedures and safety precautions required by the APP and AHA. Ensure the participation of the Contractor's PM, Superintendent and the Quality Control Manager.

1.6 ACCIDENT PREVENTION PLAN (APP)

Prepare the APP in accordance with the required and advisory provisions of COE EM-385-1-1 including Appendix A, "Minimum Basic Outline for Preparation of Accident Prevention Plan," and as modified herein. Include the associated AHA and other specific plans, programs and procedures listed on Pages A-3 and A-4 of COE EM-385-1-1, some of which are called out below. On-site work shall not be authorized until the Government has approved the APP.

1.6.1 Contents of the Accident Prevention Plan

a. Name and safety related qualifications of Safety Officer (including training and any certifications).

b. Qualifications of competent and of qualified persons including competent person for excavation.

c. Identify of the individual who will complete exposure data (hours worked); accident investigations, reports and logs; and immediate notification of accidents to include subcontractors.

d. Emergency response plan. Conform to COE EM-385-1-1, paragraph 01.E and include a map denoting the route to the nearest emergency care facility with emergency phone numbers. Contractor may be required to demonstrate emergency response.

e. Hazardous Material Use. Provisions to deal with hazardous materials, pursuant to the Contract Clause "FAR 52.223-3, Hazardous Material Identification and Material Safety Data." And the following:

(1) Inventory of hazardous materials to be introduced to the site with estimated quantities.

(2) Plan for protecting personnel and property during the transport, storage and use of the materials

(3) Emergency procedures for spill response and disposal, including a site map with approximate quantities on site at any given time. The site map will be attached to the inventory, showing where the hazardous substances are stored

(4) Safety Data Sheets for inventoried materials not required in other section of this specification.

(5) Labeling system to identify contents on all containers on-site.

(6) Plan for communicating high health hazards to employees and adjacent occupants.

f. Hazardous Energy Control Plan. For hazardous energy sources, comply with COE EM-385-1-1, paragraph 12.A.07.

g. Critical Lift Procedures. Weight handling critical lift plans will be prepared and signed in accordance with COE EM-385-1-1, paragraph 16.c.18.

h. Alcohol and Drug Abuse Plan. Description of the on-site prevention program.

i. Fall Protection Plan. The plan shall be site specific and protect all workers at elevations above 6 feet.

j. Silica Exposure Reduction. The plan shall include specific procedures to prevent employee silica inhalation exposures.

k. Excavation Plan. The safety and health aspects prepared in accordance with Section 02302, "Excavation, Backfilling, and Compacting for Utilities"

1.7 ACTIVITY HAZARD ANALYSIS (AHA)

Prepare for each task order. As a minimum, define activity being performed, sequence of work, specific hazards anticipated, control measures to eliminate or reduce each hazard to acceptable levels, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall arrest systems. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include excavation safeguarding requirements. The appropriate AHA shall be reviewed and attendance documented by Contractor at the preparatory, initial, and follow-up phases of Quality Control inspection.

1.8 HEALTH AND SAFETY PLAN (HASP)

Prepare as required by 29 CFR 1910.120 and COE EM-385-1-1.

1.8.1 Contents

a. Location, size, and details of control areas.

b. Location and details of decontamination systems.

c. Interface of trades involved in the construction.

d. Sequencing of work.

e. Disposal plan.

f. Sampling protocols.

g. Testing labs.

h. Protective equipment.

i. Pollution control.

j. Evidence of compliance with 29 CFR 1910.120 and 29 CFR 1926.65.

k. Training and certifications of CIH, CSP or other competent persons.

1.9 FALL HAZARD PREVENTION PROGRAM

1.9.1 Scaffolds

Delineate the fall protection requirements necessary during the erection and dismantling operation of scaffolds used on the project in the fall protection plan and activity hazard analysis for the phase of work.

1.9.2 Training

Institute a fall protection program. As part of the Fall Protection Program, contractor shall provide training for each employee who might be exposed to fall hazards.

1.10 DUTIES OF THE SAFETY OFFICER

a. Actively participate in the development of the required safety plan submittals.

b. Monitor and ensure construction hazards are identified and corrected.

c. Maintain applicable safety reference material, including COE EM-385-1-1, on the job site.

d. Maintain a log of safety inspections performed. Report all observed safety violations and corrective actions in writing to the Government.

e. Immediately stop any work activity in the event unsafe work practices are observed which are believed to pose a serious risk to personnel safety or property.

f. Attend the pre-construction conference and routine progress meetings.

g. Provide regular safety related training and instruction to all employees performing work under this contract.

1.11 DISPLAY OF SAFETY INFORMATION

Display the following information in clear view of the on-site construction personnel:

a. Map denoting the route to the nearest emergency care facility with emergency phone numbers.

b. AHA

c. Confined space entry permit.

d. Sign with number of hours worked since last lost workday accident.

1.12 SITE SAFETY PREFERENCE MATERIALS

Maintain safety-related references applicable to the project on site, including COE EM-385-1-1 and those others listed in the article "References." Maintain applicable equipment manufacturers' manuals.

1.13 HIGH HAZARD WORK AND LONG DURATION

Work under this contract is potentially hazardous. Pursuant to contract clause "FAR 52.236-13, Accident Prevention, Alternate I," submit in writing additional proposals for effecting accident prevention under hazardous conditions.

1.14 SITE CONDITIONS

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide.

1.15 REPORTS

1.15.1 Reporting Reports

For OSHA inspections or recordable accidents, the prime contractor will conduct a suitable investigation, provide a copy of the OSHA inspection or accident report to the Government, and identify corrective actions. Provide findings and reports to the Government within 5 calendar days of the inspection or accident.

1.15.2 Notification

Notify the Contracting Officer, within 4 hours, of any accident meeting the definition of OSHA recordable occupational injury or illness. Information shall include Contractor name; contract title; type of contract; name of activity, installation or location where mishap occurred; date and time of mishap; names of personnel injured; extent of property damage, if any; and brief description of mishap (to include type of construction equipment used, PPE used, etc.) In addition to OSHA reporting requirements, initial notification shall be made of any accident involving significant mishaps.

1.15.3 OSHA Citations and Violations

Provide the PM and Contracting Officer with a copy of each OSHA citation, OSHA report and Contractor response. Correct violations and citations promptly and provide written corrective actions to the Government.

PART 2 PRODUCTS

2.1 FALL PROTECTION ANCHORAGE

Fall protection anchorages, used by contractors to protect their people, will be left in place and so identified for continued customer use.

PART 3 EXECUTION

3.1 CONSTRUCTION

Comply with COE EM-385-1-1, NFPA 241, the accident prevention plan, the activity hazard analysis and other related submittals and activity fire and safety regulations.

3.1.1 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited.

3.1.2 Unforeseen Hazardous Material

The task order should have identified materials such as PCB, lead paint, and friable and nonfriable asbestos. If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer, ConRep and COR immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or

poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages a minimum of 15 days in advance. As a minimum, the request should include the location of the outage, utilities being effected, duration of outage and any necessary sketches. Once approved and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Construction Representative to review the scope of work and the lock out/tag out procedures for worker protection.

3.3 PERSONNEL PROTECTION

3.3.1 Hazardous Noise

Provide hazardous noise signs, and hearing protection, where ever equipment and work procedures produce sound-pressure levels greater than 85 dBA steady state or 140 dBA impulse, regardless of the duration of the exposure.

3.3.2 Fall Protection

Enforce use of the fall protection device named for each activity in the AHA all times when an employee is on a surface 6 feet or more above lower levels. Personal fall arrest systems are required when working from an articulating or extendible boom, scissor lifts, swing stages, or suspended platform. Fall protection must comply with ANSI A10.14.

3.3.2.1 Personal Fall Arrest Device

Equipment, subsystems, and components shall meet ANSI Z359.1, Personal Fall Arrest Systems. Only an full-body harness with a shock absorbing lanyard is an acceptable personal fall arrest device. Body belts may only be used as positioning devices only such as for steel reinforcing assembly. Body belts are not authorized as a personal fall arrest device. Harnesses must have upper middle back "D" rings for proper body suspension during a fall. Lanyard must be fitted with a double locking snap hook attachment. Webbing, straps, and ropes must be of synthetic fiber or wire rope.

3.3.2.2 Fall Protection for Roofs

a. For work within 6 feet of an edge, on low pitched roofs, personnel shall be protected by use of personal fall arrest systems, guardrails, safety nets. Safety monitoring system is not adequate fall protection and is not authorized.

b. For work greater than 6 feet from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.502(f).

c. Work on steep roofs requires personal fall arrest, guardrails with toeboards, or safety nets. This requirement includes residential or housing type construction.

3.3.2.3 Safety Nets

Safety nets shall be provided in unguarded workplaces over water, machinery, dangerous operations, or more than 25 feet above surface.

3.3.3 Scaffolding

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Contractor shall ensure that scaffold erection is performed by employees that are qualified. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection plan. Minimum platform size shall be based on the platform not being greater in height than four times the dimension of the smallest width dimension for rolling scaffold. Some Baker type scaffolding has been found not to meet these requirements. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. The first tie-in shall be at the height equal to 4 times the width of the scaffold base.

3.3.4 Use of Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufactures printed operating instructions. Crane supported work platforms shall only be used in extreme conditions if the Contractor proves that using any other access to the work location would provide a greater hazard to the workers.

b. Cranes must be equipped with Load Indicating Devices, anti-two blocks devices, load, boom angle moment indicating indicators.

c. Christmas-tree lifting (multiple rigged materials) is not allowed.

3.3.5 Excavations

The Safety Officer shall be on site when work is being performed in excavation, and shall inspect excavations prior to entry by workers. Individual must evaluate for all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

3.3.6 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cable intended to be cut must be positively identified and de-energized prior to performing each cut. Perform all high voltage cutting remotely. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high

voltage personnel must use personnel protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor AHA.

3.3.7 Crystalline Silica

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and COE EM-385-1-1, (Appendix C). The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.4 ACCIDENT SCENE PRESERVATION

For serious accidents, ensure the accident site is secured and evidence is protected remaining undisturbed until released by the Contracting Officer.

3.5 FIELD QUALITY CONTROL

3.5.1 Inspection

Include safety inspection as a part of the daily Quality Control inspections required in Section 01 45 00, "Quality Control."

-- End of Section --

SECTION 01 57 19.00 20

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004	(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)
EPA 833-R-060-04	(2000) Developing Your Storm Water Pollution Prevention Plan, a Guide for Construction Sites

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 271	Requirements for Authorization of State Hazardous Waste Programs
40 CFR 272	Approved State Hazardous Waste Management Programs
40 CFR 273	Standards For Universal Waste Management
40 CFR 279	Standards for the Management of Used Oil
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 355	Emergency Planning and Notification
40 CFR 372-SUBPART D	Specific Toxic Chemical Listings
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Garbage, refuse, debris, sludge, or other discharged material, including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations. Types of solid waste typically generated at construction sites may include:

a. Green waste: The vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

b. Surplus soil: Existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included.

c. Debris: Non-hazardous solid material generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

d. Wood: Dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated and/or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included.

e. Scrap metal: Scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

f. Paint cans: Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.

g. Recyclables: Materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company. Paint cans may be included as recyclable if sold to a scrap metal company.

h. Hazardous Waste: By definition, to be a hazardous waste a material must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste.They have

additional regulatory controls and must be handled separately. They are thus defined separately in this document.

Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.3 Hazardous Debris

As defined in Solid Waste paragraph, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) per 40 CFR 261; or debris that exhibits a characteristic of hazardous waste per 40 CFR 261.

1.2.4 Chemical Wastes

This includes salts, acids, alkalizes, herbicides, pesticides, and organic chemicals.

1.2.5 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.6 Hazardous Waste

Any discarded material, liquid, solid, or gas, which meets the definition of hazardous material or is designated hazardous waste by the Environmental Protection Agency or State Hazardous Control Authority as defined in 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 271, 40 CFR 272, 40 CFR 273, 40 CFR 279, and 40 CFR 280.

1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that:

a. Is regulated as a hazardous material per 49 CFR 173, or

b. Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.120, or

c. During end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical

waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.8 Waste Hazardous Material (WHM)

Any waste material which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial hazard to human health or the environment and which has been so designated. Used oil not containing any hazardous waste, as defined above, falls under this definition.

1.2.9 Oily Waste

Those materials which are, or were, mixed with used oil and have become separated from that used oil. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, used oil and may be appropriately tested and discarded in a manner which is in compliance with other State and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that:

a. It is not prohibited in other State regulations or local ordinances

b. The amount generated is "de minimus" (a small amount)

c. It is the result of minor leaks or spills resulting from normal process operations

d. All free-flowing oil has been removed to the practical extent possible

Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, a hazardous waste determination must be performed prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.10 Regulated Waste

Those solid waste that have specific additional Federal, state, or local controls for handling, storage, or disposal.

1.2.11 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

chlorofluorocarbon-11 (CFC-11)
chlorofluorocarbon-12 (CFC-12)
chlorofluorocarbon-13 (CFC-13)
chlorofluorocarbon-111 (CFC-111)

chlorofluorocarbon-112 (CFC-112)
chlorofluorocarbon-113 (CFC-113)
chlorofluorocarbon-114 (CFC-114)
chlorofluorocarbon-115 (CFC-115)
chlorofluorocarbon-211 (CFC-211)
chlorofluorocarbon-212 (CFC-212)
chlorofluorocarbon-213 (CFC-213)
chlorofluorocarbon-214 (CFC-214)
chlorofluorocarbon-215 (CFC-215)
chlorofluorocarbon-216 (CFC-216)
chlorofluorocarbon-217 (CFC-217)
chlorofluorocarbon-500 (CFC-500)
chlorofluorocarbon-502 (CFC-502)
chlorofluorocarbon-503 (CFC-503)
halon-1211
halon-1301
halon-2402
carbon tetrachloride
methyl bromide
methyl chloroform

Class II ODS is defined in Section 602(s) of The Clean Air Act and includes the following chemicals:

hydrochlorofluorocarbon-21 (HCFC-21)
hydrochlorofluorocarbon-22 (HCFC-22)
hydrochlorofluorocarbon-31 (HCFC-31)
hydrochlorofluorocarbon-121 (HCFC-121)
hydrochlorofluorocarbon-122 (HCFC-122)
hydrochlorofluorocarbon-123 (HCFC-123)
hydrochlorofluorocarbon-124 (HCFC-124)
hydrochlorofluorocarbon-131 (HCFC-131)
hydrochlorofluorocarbon-132 (HCFC-132)
hydrochlorofluorocarbon-133 (HCFC-133)
hydrochlorofluorocarbon-141 (HCFC-141)
hydrochlorofluorocarbon-142 (HCFC-142)
hydrochlorofluorocarbon-221 (HCFC-221)
hydrochlorofluorocarbon-222 (HCFC-222)
hydrochlorofluorocarbon-223 (HCFC-223)
hydrochlorofluorocarbon-224 (HCFC-224)
hydrochlorofluorocarbon-225 (HCFC-225)
hydrochlorofluorocarbon-226 (HCFC-226)
hydrochlorofluorocarbon-231 (HCFC-231)
hydrochlorofluorocarbon-232 (HCFC-232)
hydrochlorofluorocarbon-233 (HCFC-233)
hydrochlorofluorocarbon-234 (HCFC-234)
hydrochlorofluorocarbon-235 (HCFC-235)
hydrochlorofluorocarbon-241 (HCFC-241)
hydrochlorofluorocarbon-242 (HCFC-242)
hydrochlorofluorocarbon-243 (HCFC-243)
hydrochlorofluorocarbon-244 (HCFC-244)
hydrochlorofluorocarbon-251 (HCFC-251)
hydrochlorofluorocarbon-252 (HCFC-252)
hydrochlorofluorocarbon-253 (HCFC-253)
hydrochlorofluorocarbon-261 (HCFC-261)
hydrochlorofluorocarbon-262 (HCFC-262)
hydrochlorofluorocarbon-271 (HCFC-271)

1.2.11.1 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (e.g., thermostats) and lamps (e.g., fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey;

Solid Waste Management Plan and Permit;

Regulatory Notifications;

Environmental Management Plan;

Storm Water Pollution Prevention Plan;

Storm Water Notice of Intent (for NPDES coverage under the general permit for construction activities);

Dirt and Dust Control Plan

Contractor Hazardous Material Inventory Log;

SD-06 Test Reports

Laboratory Analysis

Disposal Requirements

Erosion and Sediment Control Inspection Reports

Storm Water Inspection Reports for General Permit

Contractor 40 CFR employee training records Solid

Waste Management Report;

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with

Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

The Contractor may be required to promptly conduct tests and procedures for the purpose of assessing whether construction operations are in compliance with Applicable Environmental Laws. Analytical work shall be done by qualified laboratories; and where required by law, the laboratories shall be certified.

1.4.1 Environmental Compliance Assessment Training and Tracking System (ECATTS)

The Superintendent is responsible for environmental compliance on task orders unless an Environmental Manager is named. The Superintendent (and alternative Superintendent) or Environmental Manager shall complete ECATTS training prior to starting respective portions of on-site work under this contract. If personnel changes occur for any of these positions after starting work, replacement personnel shall complete ECATTS training within 14 days of assignment to the contract.

Submit an ECATTS certificate of completion for personnel who have completed the required "Environmental Compliance Assessment Training and Tracking System (ECATTS)" training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

This training has been structured to allow contractor personnel to receive credit under this contract and also to carry forward credit to future contracts. Contractors shall ensure that the QC Manager (and alternate QC Manager) or Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific State regulatory requirements; therefore, Contractors working in multiple states will be requires to re-take modules tailored to the state where the contract work is being performed.

ECATTS is available for use by all contractor and subcontractor personnel associated with this project. These other personnel are encouraged (but not required) to take the training and may do so at their discretion.

1.4.2 Conformance with the Environmental Management System

The Contractor shall perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to objectives and targets, environmental programs and operational controls identified by the EMS. The Contractor will provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, the Contractor shall take corrective and/or preventative actions. In addition, the Contractor shall ensure that its employees are aware of their roles and responsibilities under the EMS and how these EMS roles and responsibilities affect work performed under the contract.

The Contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and keep up to date on regulatory required specific training for the type of work to be conducted onsite. All on-site Contractor personnel, and their subcontractor personnel, performing tasks that have the potential to cause a significant environmental impact shall be competent on the basis of appropriate education, training or experience. Upon contract award, the Contracting Officer's Representative will notify the installation's EMS coordinator to arrange EMS training. The installation's EMS coordinator shall identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. The Contractor shall provide training documentation to the Contracting Officer. The EMS coordinator shall retain associated records.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey

Perform a Preconstruction Survey of task order sites, and take photographs showing existing environmental conditions in and adjacent to the site.

1.5.2 Regulatory Notifications

The Contractor is responsible for all regulatory notification requirements in accordance with Federal, State and local regulations. The Contractor shall submit copies of all regulatory notifications to the Contracting Officer prior to commencement of work activities.

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting.

Prior to initiating any work on site, meet with the PM to develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, required permits, permit requirements, and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager will be directly responsible for coordinating contractor compliance with Federal, State, local, and station requirements. The Environmental Manager will ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the Environmental Management Plan; ensure that all environmental permits are obtained, maintained, and closed out; ensure compliance with Storm Water Program Management requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral duty of the Superintendent; however the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure all Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder

and required documentation, including environmental permits compliance and close-out.

1.5.5 Contractor 40 CFR Employee Training Records

Prepare and maintain employee training records throughout the term of the contract meeting applicable 40 CFR requirements. The Contractor will ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with Federal, State and local regulatory requirements for RCRA Large Quantity Generator. The Contractor will provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ENVIRONMENTAL MANAGEMENT PLAN

Prior to initiating any work on site, the Contractor will meet with the Contracting Officer to discuss the proposed Environmental Protection Plan and develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. The Contractor's Environmental Plan shall incorporate construction related objectives and targets from the installation's Environmental Management System. The Environmental Management Plan will be submitted in the following format and shall include the elements specified below.

a.Description of the Environmental Management Plan

(1) General overview and purpose

(a) A brief description of each specific plan required by environmental permit or elsewhere in this contract.

(b) The duties and level of authority assigned to the person(s) on the job site that oversee environmental compliance.

(c) A copy of any standard or project specific operating procedures that will be used to effectively manage and protect the environment on the project site.

(d) Communication and training procedures that will be used to convey environmental management requirements to contractor employees and subcontractors.

(e) Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

(2) General site information

(3) A letter signed by an officer of the firm appointing the Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract.

b. Management of Natural Resources

(1) Land resources

(2) Tree protection

(3) Replacement of damaged landscape features

(4) Temporary construction

(5) Stream crossings

(6) Fish and wildlife resources

(7) Wetland areas

c. Protection of Historical and Archaeological Resources

(1) Objectives

(2) Methods

d. Storm Water Management and Control

(1) Ground cover

(2) Erodible soils

(3) Temporary measures

(a) Mechanical retardation and control of runoff

(b) Vegetation and mulch

(4) Effective selection, implementation and maintenance of Best Management Practices (BMPs).

e. Protection of the Environment from Waste Derived from Contractor Operations

(1) Control and disposal of solid and sanitary waste.

(2) Control and disposal of hazardous waste (Hazardous Waste Management Section)

This item will consist of the management procedures for all hazardous waste to be generated. The elements of those procedures will coincide with the Activity Hazardous Waste Management Plan. A copy of the Activity Hazardous Waste Management Plan will be provided by the Contracting Officer. As a minimum, include the following:

(a) Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated;

(b) Sampling/analysis plan;

(c) Methods of hazardous waste accumulation/storage (i.e., in tanks and/or containers);

(d) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted);

(e) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268);

(f) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and the like;

(g) Used oil management procedures in accordance with 40 CFR 279;

(h) Pollution prevention\hazardous waste minimization procedures;

(i) Plans for the disposal of hazardous waste by permitted facilities;

(j) Procedures to be employed to ensure all required employee training records are maintained.

f. Prevention of Releases to the Environment

(1) Procedures to prevent releases to the environment

(2) Notifications in the event of a release to the environment

g. Regulatory Notification and Permits

List what notifications and permit applications must be made. Demonstrate that those permits have been obtained by including copies of all applicable, environmental permits.

3.1.1 Environmental Protection Plan Review

Within thirty days after the Contract award date, submit the proposed Environmental Management Plan for further discussion, review, and approval. Commencement of work will not begin until the environmental management plan has been approved.

3.1.2 Licenses and Permits

Obtain licenses and permits pursuant to the "Permits and Responsibilities" FAR Clause 52.236-7.

No permits will be obtained by the Contracting Officer.

3.2 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. If the work is near streams, lakes, or other waterways, conform to the national permitting requirements of the Clean Water Act.

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor will be responsible for any resultant damage.

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

3.2.1 Erosion and Sediment Control Measures

3.2.1.1 Burnoff

Burnoff of the ground cover is not permitted.

3.2.1.2 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.2.1.3 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

a. Mechanical Retardation and Control of Runoff

Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.

b. Sediment Basins

(1) Trap sediment in temporary sediment basins. Select a basin size to accommodate the runoff of a local 5-year storm. Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs.

(2) Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare BMP Inspection Reports as required by the general permit. If required by the permit, include those inspection reports.

c. Vegetation and Mulch

(1) Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

(2) Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish or reestablish a suitable stand of grass. The seeding operation will be as specified in Section 32 92 19 SEEDING.

3.2.2 Erosion and Sediment Control Inspection Reports

Submit "Erosion and Sediment Control Inspection Reports" (E&S) (form provided at the pre-construction conference) and Storm Water Inspection Reports for General Permit for General Permit to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch or more of rain.

Note erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports if applicable.

3.2.2.1 Storm Water Notice of Intent for Construction Activities and Storm Water Pollution Prevention Plan

The Contractor shall submit a Storm Water Notice of Intent (for NPDES coverage under the general permit for construction activities) and a Storm Water Pollution Prevention Plan (SWPPP) for the contract to the Contracting Officer prior and gain approval prior to the commencement of work. The SWPPP will meet the requirements of the EPA or State general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate Federal or State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. The Contractor shall maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, reflecting current site conditions.

Coverage under this permit requires the contractor prepare a Storm Water Pollution Prevention Plan (SWPPP), prepare and submit a Registration

Statement as a co-permittee with the CO, and provide the permit fee to the responsible state agency before any land disturbing activities begin. The contractor shall file for permit coverage on behalf CO and himself and file a Notice of Termination once construction is complete and the site is stabilized with a final sustainable cover.

Under the terms and conditions of the permit, the Contractor may be required to install, inspect, maintain best management practices (BMPs), and submit stormwater BMP inspection reports and stormwater pollution prevention plan inspection reports. The Contractor shall ensure construction operations and management are constantly in compliance with the terms and conditions of the general permit for storm water discharges from construction activities.

a. The SWPPP shall:

(1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

(2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

(3) Ensure compliance with terms of the EPA or State general permit for storm water discharge.

(4) Select applicable best management practices from EPA 833-R-060-04.

(5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

(6) Storm Water Pollution Prevention Measures and Notice of Intent 40 CFR 122.26, EPA 833-R-060-04. Provide a "Storm Water Pollution Prevention Plan" (SWPPP) for the project. The SWPPP will meet the requirements of the EPA or State general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate Federal or State agency for approval, a minimum of 14 calendar days prior to the start of construction. A copy of the approved SWPPP will be kept at the construction on-site office, and continually updated as regulations require reflecting current site conditions.

3.2.2.2 Storm Water Pollution Prevention Plan Compliance Notebook

The contractor shall create and maintain a binder of documents that demonstrate compliance with the Stormwater Construction Activity permit.

3.2.3 Stormwater Drainage and Construction Dewatering

There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to the river without prior specific authorization of the Environmental Division in writing. Discharge of hazardous substances will not be permitted under any circumstances.

Construction site runoff will be prevented from entering any storm drain or the river directly by the use of straw bales or other method suitable to the Environmental Division. Contractor will provide erosion protection of the surrounding soils.

Construction Dewatering shall not be discharged to the sanitary sewer. If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Authorization for any contaminated groundwater release shall be obtained in advance from the base Environmental Officer. Discharge of hazardous substances will not be permitted under any circumstances.

3.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Upon discovery, notify the Contracting Officer. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.4 SOLID WASTE MANAGEMENT PLAN AND PERMIT

Provide to the contracting officer written notification of the quantity of solid waste/debris that is anticipated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance or as applicable, submit one copy of a State and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

3.4.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

The Contractor will include copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, the Contractor may submit a statement indicating the disposal location for the solid waste which is signed by an officer of the Contractor firm authorized to legally obligate or bind the firm. The sales documentation or Contractor certification will include the receiver's tax identification number and business, EPA or State registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained by the Contractor for his own use, the Contractor will submit on the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.4.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged and can be coordinated with the Contracting Officer and the activity recycling coordinator. Remove all solid waste (including non-hazardous debris) from Government property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage spent hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, as per environmental law.

3.4.2.1 Dumpsters

Equip dumpsters with a secure cover and paint the standard base color. Keep cover closed at all times, except when being loaded with trash and debris. Empty site dumpsters as needed to keep the site free of debris and trash. For large demolitions, large dumpsters without lids are acceptable but should not have debris higher than the sides before emptying.

3.5 WASTE DETERMINATION DOCUMENTATION

Complete a Waste Determination form (provided at the pre-construction conference) for all contractor derived wastes to be generated. Base the waste determination upon either a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated, EPA approved analytical data, or laboratory analysis (Material Safety Data Sheets (MSDS) by themselves are not adequate). Attach all support documentation to the Waste Determination form. As a minimum, a Waste Determination form must be provided for the following wastes (this listing is not all inclusive): oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and all containers of the original materials.

3.6 CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG

Submit the "Contractor Hazardous Material Inventory Log"(found at: http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.6.1 Disposal Documentation for Hazardous and Regulated Waste

Manifest, pack, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of construction in accordance with the generating facilities generator status under the Recourse Conservation and Recovery Act. Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or State permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifest must be reviewed, signed, and approved before the Contractor may ship waste. To obtain specific disposal instructions the Contractor must coordinate with the environmental office.

3.7 POLLUTION PREVENTION/HAZARDOUS WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of hazardous waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the Environmental Management Plan. Consult with the activity Environmental Office for suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for reference material when preparing this part of the plan. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the types of the hazardous materials expected to be used in the construction when requesting information.

3.8 WHM/HW MATERIALS PROHIBITION

No waste hazardous material or hazardous waste shall be disposed of on government property. No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract. The government is not responsible for disposal of Contractor's waste material brought on the job site and not required in the performance of this contract. The intent of this provision is to dispose of that waste identified as waste hazardous material/hazardous waste as defined herein that was generated as part of this contract and existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. Incidental materials used to support the contract including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive. The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or to the river or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

3.9 HAZARDOUS MATERIAL MANAGEMENT

No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract.

Include hazardous material control procedures in the Safety Plan. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Submit a MSDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on base. Typical materials requiring MSDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of

hazardous materials have NFPA labels or their equivalent. Keep copies of the MSDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project. Certify that all hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste per 40 CFR 261.

3.10 PETROLEUM PRODUCTS AND REFUELING

Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed of at Contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

3.10.1 Oily and Hazardous Substances

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

3.10.2 Inadvertent Discovery of Petroleum Contaminated Soil or Hazardous Wastes

If petroleum contaminated soil or suspected hazardous waste is found during construction that was not identified in the contract documents, the contractor shall immediately notify the contracting officer. The contractor shall not disturb this material until authorized by the contracting officer.

3.11 FUEL TANKS

Petroleum products and lubricants required to sustain up to 30 days of construction activity may be kept on site. Storage and refilling practices shall comply with 40 CFR Part 112. Secondary containment shall be provided and be no less than 110 percent of the tank volume plus five inches of free-board. If a secondary berm is used for containment then the berm shall be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Drips pans are required and the tanks must be covered during inclement weather.

3.12 RELEASES/SPILLS OF OIL AND HAZARDOUS SUBSTANCES

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Contracting Officer.

The Contractor is responsible for verbal and written notifications as required by the federal 40 CFR 355, State, local regulations and Homeland Security Instructions. Spill response will be in accordance with 40 CFR 300 and applicable State and local regulations. Contain and clean up these spills without cost to the Government. If Government assistance is requested or required, the Contractor will reimburse the Government for such assistance. Provide copies of the written notification and documentation that a verbal notification was made within 20 days.

Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous (WHM) waste spills. The Contractor shall reimburse the government for all material, equipment, and clothing generated during any spill cleanup. The Contractor shall reimburse the government for all costs incurred including sample analysis materials, equipment, and labor if the government must initiate its own spill cleanup procedures, for Contractor responsible spills, when:

a. The Contractor has not begun spill cleanup procedure within one hour of spill discovery/occurrence, or

b. If, in the government's judgment, the Contractor's spill cleanup is not adequately abating life threatening situation and/or is a threat to any body of water or environmentally sensitive areas.

3.13 CONTROL AND MANAGEMENT OF HAZARDOUS WASTES

3.13.1 Facility Hazardous Waste Generator Status

FLETC is designated as a Large Quantity Generator. All work conducted within the boundaries of this activity must meet the regulatory requirements of this generator designation. The Contractor will comply with all provisions of Federal, State and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of all construction derived wastes.

3.13.2 Hazardous Waste/Debris Management

Identify all construction activities which will generate hazardous waste/debris. Provide a documented waste determination for all resultant waste streams. Hazardous waste/debris will be identified, labeled, handled, stored, and disposed of in accordance with all Federal, State, and local regulations including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the Environmental Protection Plan. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government.

Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by activity personnel from the Environmental Office. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-

SUBPART D. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.13.2.1 Regulated Waste Storage/Satellite Accumulation/90 Day Storage Areas

If the work requires the temporary storage/collection of regulated or hazardous wastes, the Contractor will request the establishment of a Regulated Waste Storage Area, a Satellite Accumulation Area, or a 90 Day Storage Area at the point of generation. The Contractor must submit a request in writing to the Contracting Officer providing the following information:

Contract Number	_____	Contractor	_____
Haz/Waste or Regulated Waste POC	_____	Phone Number	_____
Type of Waste	_____	Source of Waste	_____
Emergency POC	_____	Phone Number	_____

Location of the Site: _____
(Attach Site Plan to the Request)

Attach a waste determination form. Allow ten working days for processing this request. The designated area where waste is being stored shall be barricaded and a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.13.2.2 Sampling and Analysis of HW

a. Waste Sampling

Sample waste in accordance with EPA 530/F-93/004. Each sampled drum or container will be clearly marked with the Contractor's identification number and cross referenced to the chemical analysis performed.

b. Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. The Contractor will provide all analytical results and reports performed to the Contracting Officer

c. Analysis Type

Identify waste hazardous material/hazardous waste by analyzing for the following properties as a minimum: ignitability, corrosiveness, total chlorides, BTU value, PCBs, TCLP for heavy metals, and cyanide.

3.13.2.3 Asbestos Certification

Items, components, or materials disturbed by or included in work under this contract do involve asbestos. Other materials in the general area around

where work will be performed may contain asbestos. All thermal insulation, in all work areas, should be considered to be asbestos unless positively identified by conspicuous tags or previous laboratory analysis certifying them as asbestos free.

Inadvertent discovery of non-disclosed asbestos that will result in an abatement action requires a change in scope before proceeding. Upon discovery of asbestos containing material not identified in the contract documents, the Contractor shall immediately stop all work that would generate further damage to the material, evacuate the asbestos exposed area, and notify the Contracting Officer for resolution of the situation prior to resuming normal work activities in the affected area. The Contractor will not remove or perform work on any asbestos containing materials without the prior approval of the Contracting Officer. The Contractor will not engage in any activity, which would remove or damage such materials or cause the generation of fibers from such materials.

Asbestos containing waste shall be managed and disposed of in accordance with applicable environmental law. Asbestos containing waste shall be manifested and the manifest provided to the Contracting Officer.

3.13.2.4 Hazardous Waste Disposal

No hazardous, toxic, or universal waste shall be disposed or hazardous material abandoned on government property. And unless otherwise noted in this contract, the government is not responsible for disposal of Contractor generated waste material. The disposal of incidental materials used to accomplish the work including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive.

The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or water way or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

Control of stored waste, packaging, sampling, analysis, and disposal will be determined by the details in the contract. The requirements for jobs in the following paragraphs will be used as the guidelines for disposal of any hazardous waste generated.

a. Responsibilities for Contractor's Disposal

Contractor responsibilities include any generation of WHM/HW requiring Contractor disposal of solid waste or liquid.

(1) The Contractor agrees to provide all service necessary for the final treatment/disposal of the hazardous material/waste in accordance with all local, State and Federal laws and regulations, and the terms and conditions of the contract within sixty (60) days after the materials have been generated. These services will include all necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal, and/or transportation, including manifesting or completing waste profile sheets, equipment, and the compilation of all documentation is required).

(2) Contain all waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 272, 40 CFR 273, 40 CFR 279, 40 CFR 280, and 40 CFR 761.

(3) Obtaining a representative sample of the material generated for each job done to provide waste stream determination.

(4) Analyzing for each sample taken and providing analytical results to the Contracting Officer. Provide two copies of the results.

(5) Determine the DOT proper shipping names for all waste (each container requiring disposal) and will demonstrate how this determination is developed and supported by the sampling and analysis requirements contained herein to the Contracting Officer.

Contractor Disposal Turn-In Requirements

For any waste hazardous materials or hazardous waste generated which requires the Contractor to dispose of, the following conditions must be complied with in order to be acceptable for disposal:

a. Drums compatible with waste contents and drums meet DOT requirements for 49 CFR 173 for transportation of materials.

b. Drums banded to wooden pallets. No more than three (3) 55 gallon drums to a pallet, or two (2) 85 gallon over packs.

c. Band using 1-1/4 inch minimum band on upper third of drum.

d. Recovery materials label (provided by Code 106.321) located in middle of drum, filled out to indicate actual volume of material, name of material manufacturer, other vendor information as available.

e. Always have three (3) to five (5) inches of empty space above volume of material. This space is called 'outage'.

3.13.3 Class I and II ODS Prohibition

Class I ODS as defined and identified herein will not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition will be considered to prevail over any other provision, specification, drawing, or referenced documents. Regulations related to the protection of stratosphere ozone may be found in 40 CFR 82.

Heating and air conditioning technicians must be certified through an EPA-approved program. Copies of certifications shall be maintained at the employees' place of business and be carried as a wallet card by the technician, as provided by environmental law. Accidental venting of a refrigerant is a release and shall be reported to the Contracting Officer.

3.13.3.1 Universal Waste/e-Waste Management

Universal waste including but not limited to some mercury containing building products such florescent lamps, mercury vapor lamps, high pressure sodium lamps, CRTs, batteries, aerosol paint containers, electrical equipment containing PCBs, and consumed electronic devices, shall be managed

in accordance with applicable environmental law and installation instructions.

3.14 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.14.1 Dirt and Dust Control Plan

Submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

3.15 ABRASIVE BLASTING

3.15.1 Blasting Operations

The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive, agent, paint chips, and other debris in accordance with the requirements specified. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.15.2 Disposal Requirements

Submit analytical results of the debris generated from abrasive blasting operations per paragraph entitled Laboratory Analysis of this section. Hazardous waste generated from blasting operations will be managed in accordance with paragraph entitled "Hazardous Waste\Debris Management" of this section and with the approved HWMP. Disposal of non-hazardous abrasive blasting debris will be in accordance with paragraph entitled, "Control and Disposal of Solid Wastes".

3.16 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated times.

3.17 MERCURY MATERIALS

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the Environmental Office and the

Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal.

-- End of Section --

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4439	(2004) Geosynthetics
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 SYSTEM DESCRIPTION

The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies in conformance with the requirements of the National Pollutant Discharge Elimination System (NPDES).

1.3 EROSION AND SEDIMENT CONTROLS

The controls and measures required of the Contractor are described below.

1.3.1 Stabilization Practices

The stabilization practices to be implemented include temporary seeding, mulching, geotextiles, and protection of trees. On the daily CQC Report, record the dates when the major grading activities occur, (e.g., clearing and grubbing, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS, initiate stabilization practices as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.3.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases or is precluded by unsuitable conditions caused by the weather, initiate stabilization practices as soon as practicable after conditions become suitable.

1.3.1.2 Burnoff

Burnoff of the ground cover is not permitted.

1.3.1.3 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified, and protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

1.3.2 Erosion, Sediment and Stormwater Control

a. Submit a Storm Water Notice of Intent for NPDES coverage under the general permit for construction activities and a Storm Water Pollution Prevention Plan (SWPPP) for the project to the Contracting Officer prior to the commencement of work. The SWPPP shall meet the requirements of the State of Georgia general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. Maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, toreflect current site conditions. Include within the SWPPP:

(1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

(2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

(3) Ensure compliance with terms of the State of Georgia general permit for storm water discharge.

(4) Select applicable best management practices from EPA 832-R-92-005.

(5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

1.3.3 Structural Practices

Implement structural practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement structural practices in a timely manner, during the construction process, to minimize erosion and sediment runoff. Include the following devices; Location and details of installation and construction are shown on the drawings.

1.3.3.1 Silt Fences

Provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Properly install silt fences to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Install silt fences in the locations indicated on the drawings. Obtain approval from the Contracting Officer prior to final removal of silt fence barriers.

1.3.4 Vegetation and Mulch

a. Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

b. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to reestablish a suitable stand of grass. The seeding operation will be as specified in Section 32 92 19 SEEDING.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Storm Water Pollution Prevention Plan

Storm Water Notice of Intent

Pollution prevention plan and Notice of intent for NPDES coverage under the general permit for construction activities

SD-06 Test Reports

Erosion and Sediment Controls

SD-07 Certificates

Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

Identify, store and handle filter fabric in accordance with ASTM D4873.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

Provide geotextile that complies with the requirements of ASTM D4439, and consists of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and contains stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Provide synthetic filter fabric that contains ultraviolet ray inhibitors and stabilizers to assure a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE		
PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile Elongation (percent)	ASTM D4632	445 N100 lbs. min. 30 percent max.
Trapezoid Tear	ASTM D4533	245 N min.55 lbs. min.
Permittivity	ASTM D4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D4751	20-100

2.1.2 Silt Fence Stakes and Posts

Use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 by 2 inches when oak is used and 4 by 4 inches when pine is used, and have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

Provide a mill certificate or affidavit attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. Specify in the mill certificate or affidavit the actual Minimum Average Roll Values and identify the fabric supplied by roll identification numbers. Submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Extend silt fences a minimum of 24 inches above the ground surface without exceeding 34 inches above the ground surface. Provide filter fabric from a

continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, splice together filter fabric at a support post, with a minimum 8 inch overlap, and securely sealed. Excavate trench approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Remove silt fences upon approval by the Contracting Officer.

3.2 FIELD QUALITY CONTROL

Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

3.2.1 Silt Fence Maintenance

Inspect the silt fences in accordance with paragraph, titled "Inspections," of this section. Any required repairs shall be made promptly. Pay close attention to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, replace the fabric promptly. Remove sediment deposits when deposits reach one-third of the height of the barrier. Remove a silt fence when it is no longer required. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall receive erosion control.

3.3 INSPECTIONS

3.3.1 General

Inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit a site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Conduct inspections at least once every month where sites have been finally stabilized.

3.3.2 Inspections Details

Inspect disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system. Observe erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan to ensure that they are operating correctly. Inspect discharge locations or points to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Inspect locations where vehicles exit the site for evidence of offsite sediment tracking.

3.3.3 Inspection Reports

For each inspection conducted, prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection,

the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. Furnish the report to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 1971	(2005) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2000; R 2009) Industrial and Institutional Cleaners

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08	(2009, with Change 1) Criteria for Transfer and Acceptance of DoD Real Property

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials
Warranty
Final Cleaning

SD-08 Manufacturer's Instructions

Preventative Maintenance
Inspection
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

Drawings showing final as-built conditions of the task order. This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions.

1.3.1.1 Not used

1.3.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes.

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

g. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications

1.3.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract

set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate.

1.4 MECHANICAL TESTING AND BALANCING

All contract requirements of Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC must be fully completed, including all testing, prior to contract completion date. In addition, all contract requirements of Section 23 05 93 TESTING, ADJUSTING AND BALANCING must be fully completed, including testing and inspection, prior to contract completion date

1.5 OPERATION AND MAINTENANCE MANUALS

Submit two copies of the project operation and maintenance manuals.

1.5.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data are to be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.5.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the task order provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services.

1.6 CLEANUP

Provide final cleaning in accordance with ASTM E 1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and remove construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport off site and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on site.

Submit documentation for all materials removed from FLETC (e.g. recyclables, solid waste, etc.). Submit disposal/recycling tickets and truck transportation tickets for all material loads removed from FLETC. All transportation and landfill tickets shall bear the original signatures, load weights, and name of disposal/recycling facility. Provide for proper chain-of-custody for all materials, project site to disposal/recycling site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 81 19

INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 008	(2007) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SUMMARY

Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out after construction, pre-occupancy.

1.3 DESCRIPTION, GENERAL

a. IAQ Management During Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:

1. Practices which minimize the amount of dust generated.

2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.

3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.

4. No visible haze in the air.

b. IAQ Management Plan Before Occupancy: Minimize indoor pollutant concentrations to required levels prior to Owner occupancy.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction IAQ Management Plan During Construction;

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN DURING CONSTRUCTION

a. General IAQ Plan requirements during construction include:

1. Compliance with ANSI/SMACNA 008 "SMACNA Guidelines for Occupied Buildings Under Construction."

2. Provide solid physical barriers to isolate areas of construction. Securely attach and seal at floor and structure above.

3. Schedule adequate time for product installation.

4. Maintain negative pressure in construction area.

5. Do not recirculate air prior to occupancy.

6. Seal return air ducts and use direct exhaust to outside.

7. Factory age sheet goods.

8. Comply with manufacturer's instructions for appropriate drying times.

9. Protect installed absorbent materials with recycled or recyclable materials.

b. The IAQ Plan shall meet or exceed the five SMACNA requirements and shall include the following measures:

1. HVAC Protection.

2. Source Control.

3. Pathway Interruption.

4. Housekeeping.

5. Scheduling.

c. HVAC Protection:

1. Protect air handling and distribution equipment, and air supply and return ducting during construction.

2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.

3. Apply protection immediately after installation of equipment and ducting.

4. Ducting runs that require more than a single day to install shall be protected at the end of each day's Work.

5. During dust producing activities, (e.g., drywall installation and finishing), turn the ventilation system off, and protect HVAC supply and return openings from dust infiltration. Provide temporary ventilation as required.

6. If the air handling system is used during construction, MERV 8 filtration media is required on all air handling units, and return air grills or any open vents. The filter media needs to be maintained and replaced before occupancy or if it becomes clogged with debris.

d. Source Control:

1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.

2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.

3. Preconditioning:

a) Prior to delivery to the construction site allow products that have odors and significant volatile organic compound (VOC) emissions to off-gas in dry, well ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions.

b) Condition products, without containers and packaging, to maximize off-gassing of VOCs.

c) Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period.

d) Do not ventilate within limits of Work unless otherwise accepted by Contracting Officer.

e) Comply with substitution requirements for consideration of other locations.

4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.

5. Replace moldy materials with new, undamaged materials.

6. Provide sufficient ventilation, air circulation and air changes to dissipate excess humidity when present.

e. Pathway Interruption:

1. All openings within the designated work area shall be sealed.

2. Adequate exhaust ventilation equipment shall be installed to maintain a negative pressure differential between the work area and adjacent areas of the building.

3. Ventilation units shall be exhausted to the outside of the building.

f. Housekeeping:

1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.

2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:

a) Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is stated in these Specifications, a period of 72 hours shall be used.

b) Ventilate areas directly to outside, do not ventilate to other enclosed spaces.

c) If continuous ventilation is not possible via the building's HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.

3. Suppress dust with wetting agents or sweeping compounds.

4. Clean-up dust using a wet rag or damp mop.

5. Increase the cleaning frequency when dust build-up is noted.

6. Remove spills or excess applications of solvent-containing products as soon as possible.

7. Remove accumulated water and keep work areas as dry as possible.

8. Store volatile liquid containers closed when the container is inside of the building and not in use.

9. Keep volatile liquid containers closed when the container is inside of the building and not in use.

10. HEPA vacuuming and duct cleaning:

a) Vacuum carpeted and soft surfaces with a high efficiency particulate arrestor (HEPA) vacuum.

b) If ducts contain dust and dirt, clean them using a HEPA vacuum immediately before substantial completion and prior to using the ducts to circulate air.

c) Oil film on sheet metal should be removed before shipment to site. However, ducts will be inspected to confirm that no oil film is present. Remove any oil.

11. Use nontoxic cleaning materials and procedures:

a) Alternatives to toxic cleaning agents include:

1) Vinegar.

2) Citrus.

3) Borax.

4) Cornstarch.

5) Baking soda.

b) Examples of nontoxic alternatives for several cleaning methods are listed below:

1) Abrasive cleaners: Substitute half lemon dipped in borax.

2) Ammonia cleaners: Substitute vinegar, salt, and water mixture; or baking soda and water.

3) Disinfectants: Substitute half cup borax in a gallon of water.

4) Drain cleaners: Substitute one fourth cup baking soda and one fourth cup vinegar in boiling water.

5) Upholstery cleaners: Substitute dry cornstarch.

g. Scheduling:

1. Where odorous and/or high VOC-emitting products are applied on site, apply them before installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.

2. Insure that wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are properly and fully cured before installing other finish materials over them.

3. Install carpets and furnishings after all other interior finish materials have been applied and fully cured.

4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.

-- End of Section --

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance with ACI MCP PACK Parts 2 and 3.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI MCP PACK	(2011) Manual of Concrete Practice

ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615/A615M	(2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C 330	(2005) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C1064/C1064M	(2008) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C143/C143M	(2010a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2010b) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2010) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2011) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2008a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2011b) Standard Specification for Ready-Mixed Concrete
ASTM D1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.3 SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in

accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples for strength tests not less than once each shift in which concrete is produced from each class of concrete required. Provide a minimum of three specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, and one will be tested at 7 days for information.

1.3.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'c, and no individual acceptance test result falls below f'c by more than 500 psi.

1.3.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed.Surface requirements for the classes of finish required are as specified in Part 4 of ACI MCP PACK.

1.3.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. Specified compressive strength f'c shall be 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 1 inch, in accordance with ACI MCP PACK Part 3. The air content shall be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water cement ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Water-Reducing or Retarding Admixture
Curing Materials
Expansion Joint Filler Strips, PremoldedJoint Sealants - Field Molded Sealants

Conveying and Placing Concrete
Formwork
Forms
Ready-Mix Concrete
Mix Design Data;
Fly Ash
Accessories, Curing Compound

SD-06 Test Reports

Aggregates
Concrete Mixture Proportions
Compressive Strength Testing
Slump

SD-07 Certificates

Cementitious Materials
Aggregates
Bill of Lading

1.5 QUALITY ASSURANCE

Indicate specific locations of Steel Reinforcement on installation drawings and include, but not be limited to, square feet of concrete placements, thicknesses and widths, plan dimensions, and arrangement of cast-in-place concrete section.

PART 2 PRODUCTS

2.1 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.1.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.1.1.1 Portland Cement

ASTM C150/C150M, Type I.

2.1.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class C or F, including requirements of Tables 1A and 2A.

2.1.2 Aggregates

Fine and coarse aggregates shall meet the quality and grading requirements of ASTM C33/C33M Class Designations 4M or better. Perform evaluation of fine and coarse aggregates separately and in combination, matching the proposed mix design proportioning. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

Aggregates for lightweight concrete shall meet ASTM C 330.

2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed.

2.1.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.1.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

2.1.4 Water

Use fresh, clean, potable water for mixing and curing, free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60. Welded steel wire fabric shall conform to the requirements of ASTM A185/A185M. Details of reinforcement not shown shall be in accordance with ACI MCP PACK Part 3, Chapters 7 and 12.

2.1.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded shall be sponge rubber conforming to ASTM D1752, Type I.

2.1.7 Joint Sealants - Field Molded Sealants

Joint sealants - field molded sealants shall conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

2.1.8 Formwork

The design and engineering of the formwork as well as its construction, will be the responsibility of the Contractor.

2.1.9 Form Coatings

Coat forms, for exposed surfaces, with a nonstaining form oil to be applied shortly before concrete is placed.

2.1.10 Curing Materials

Provide curing materials conforming to the following requirements.

2.1.10.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C171, type optional, except polyethylene film, if used, shall be white opaque.

2.1.10.2 Membrane-Forming Curing Compound

ASTM C309, Type 1-D or 2, Class A.

2.2 READY-MIX CONCRETE

a. Concrete shall be ready-mix concrete with mix design data conforming to ACI MCP PACK Part 2. Bill of Lading for each ready-mix concrete delivery shall be in accordance with ASTM C94/C94M.

b. Non-exposed concrete elements: 3000 psi minimum compressive strength.

c. Slump: 1 to 4 inch according to ASTM C143/C143M and ACI MCP PACK Part 1.

d. Portland Cement conforming to ASTM C150/C150M, Type I or II.

e. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

f. Air-Entraining Admixtures conforming to ASTM C260/C260M. Exterior concrete exposed to freezing needs to be air-entrained 4.5 to 7.5 percent by volume. Nonair-entrained interior concrete shall have a total air content of 2 to 4 percent by volume.

g. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C494/C494M.

h. Fly Ash used as an admixture shall conform to ASTM C618, Class C or F with 4 percent maximum loss on ignition and 35 percent maximum cement replacement by weight. Submit documentation in compliance with 40 CFR 247.

2.3 STEEL REINFORCEMENT

2.3.1 Deformed Steel Bars

Provide steel bars conforming to ASTM A615/A615M, Grade .60 ksi ACI MCP PACK Parts 2 and 3.

2.3.2 Welded Wire Fabric

Provide welded wire fabric conforming to ASTM A185/A185M.

2.4 FORMS

Forms shall be of wood, steel, or other approved material and conform to ACI MCP PACK, Parts 2 and 3.

Provide form release conforming to ACI MCP PACK, Part 4.

2.5 ACCESSORIES

2.5.1 Curing Compound

Provide curing compound conforming to ASTM C309.

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface shall be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Earth foundations shall be satisfactorily compacted. Ensure spare vibrators are available. The entire preparation shall be accepted by the Government prior to placing.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

3.1.2 Formwork Installation

Forms shall be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

3.1.3 Production of Concrete

3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

3.2 CONVEYING AND PLACING CONCRETE

Concrete placement is not permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, deliver the concrete to the site of the work completing the discharge within 1-1/2 hours. Convey concrete from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Deposit concrete as close as possible to its final position in the forms and regulate it so that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. Carry on the placement at such a rate that the formation of cold joints will be prevented. Submit Methods and equipment for transporting, handling, depositing, and consolidating the concrete prior to the first concrete placement. Perform conveying and placing concrete in conformance with the following:

3.2.1 Consolidation

Consolidate each layer of concrete by internal vibrating equipment. Systematically accomplish internal vibration by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by approximately 4 inches. Ensure that the vibrator penetrates rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. Hold vibrator stationary until the concrete is consolidated and then withdraw it slowly at the rate of about 3 inches per second.

3.2.2 Cold-Weather Requirements

No concrete is to be mixed or placed when the ambient temperature is below 36 degrees F or if the ambient temperature is below 41 degrees F and falling. Provide suitable covering and other means as approved for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing. Remove and replace concrete damaged by freezing at the expense of the Contractor.

3.2.3 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI MCP PACK Part 2, is expected to exceed 0.2 psf per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures taken as quickly as finishing operations will allow.

3.2.4 Lifts in Concrete

Deposit concrete in horizontal layers not to exceed 24 inches in thickness. Carry on placement at a rate that prevents the formation of cold joints. Place slabs in one lift.

3.3 FORM REMOVAL

Do not remove forms before 24 hours after concrete placement, except as otherwise specifically authorized. Do not remove supporting forms and shoring until the concrete has cured for at least 5 days. When conditions require longer curing periods, forms shall remain in place.

3.4 FINISHING

3.4.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.4.2 Finishing Formed Surfaces

Remove all fins and loose materials, and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured is the same as adjacent concrete.

3.4.3 Finishing Unformed Surfaces

Float finish all unformed surfaces, that are not to be covered by additional concrete or backfill, to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Slope exterior surfaces for drainage unless otherwise shown. Carefully make joints with a jointing tool. Finish unformed surfaces to a tolerance of 3/8 inch for a float finish and 5/16 inch for a trowel finish as determined by a 10 foot straightedge placed on surfaces shown on the drawings to be level or having a constant slope. Do not perform finishing while there is excess moisture or bleeding water on the surface. No water or cement is to be added to the surface during finishing.

3.4.3.1 Float Finish

Provide float finished surfaces, screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete supports a person's weight without deep imprint, complete floating. Floating shall embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.5 CURING AND PROTECTION

Beginning immediately after placement, and continuing for at least 7 days, cure and protect all concrete from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. Provide all materials and equipment needed for adequate curing and protection at the site of the placement prior to the start of concrete placement. Accomplish moisture preservation of moisture for concrete surfaces not in contact with forms by one of the following methods:

a. Continuous sprinkling or ponding.

b. Application of absorptive mats or fabrics kept continuously wet.

c. Application of sand kept continuously wet.

d. Application of impervious sheet material conforming to ASTM C171.

e. Application of membrane-forming curing compound conforming to ASTM C309, Type 1-D, on surfaces permanently exposed to view. Accomplish Type 2 on other surfaces in accordance with manufacturer's instructions.

Accomplish the preservation of moisture for concrete surfaces placed against wooden forms by keeping the forms continuously wet for 7 days. If forms are removed prior to end of the required curing period, use other curing methods for the balance of the curing period. Do not perform protection removal if the temperature of the air in contact with the concrete may drop more than 60 degrees F within a 24 hour period.

3.6 TESTS AND INSPECTIONS

3.6.1 Field Testing Technicians

The individuals who sample and test concrete, as required in this specification, shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.6.2 Inspection Details and Frequency of Testing

3.6.2.1 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.6.2.2 Air Content

Check air content at least once during each shift that concrete is placed for each class of concrete required. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C231/C231M.

3.6.2.3 Slump

Check slump once during each shift that concrete is produced for each class of concrete required. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C143/C143M.

3.6.2.4 Consolidation and Protection

Ensure that the concrete is properly consolidated, finished, protected, and cured.

3.6.3 Action Required

3.6.3.1 Placing

Do not permit placing to begin until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Do not continue placing if any pile is inadequately consolidated.

3.6.3.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.6.3.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

3.6.4 Reports

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within 3 days after the end of each weekly reporting period. See Section 01 45 00.00 10 QUALITY CONTROL.

3.7 FORM WORK

Form work shall conform to ACI MCP PACK Parts 2 through 5.

3.7.1 Preparation of Form Surfaces

Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces for permanently exposed faces shall be smooth, free from irregularities, dents, sags, or holes. Chamfer exposed joints and exposed edges. Arrange internal ties so that when the forms are removed, the form ties are not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structure.

3.7.2 Form Coating

Coat forms, for exposed surfaces, with a nonstaining form release coating applied. Forms for unexposed surfaces may be wetted in lieu of coating immediately before the placing of concrete, except that in freezing weather form release coating shall be used.

3.7.3 Removal of Forms

Remove forms carefully to prevent damage to the concrete. Do not remove forms before the expiration of the minimum time indicated below:

Arches, beams and deck-type slabs	144 hours
Columns and walls (lifts 15 feet and under)	24 hours
Columns and walls (lifts over 15 feet)	48 hours

3.8 STEEL REINFORCING

Reinforcement shall be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.8.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI MCP PACK Parts 2 and 3. Shop details and bending shall be in accordance with ACI MCP PACK Parts 2 and 3.

3.8.2 Splicing

Perform splices in accordance with ACI MCP PACK Parts 2 and 3.

3.8.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.9 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.10 FIELD TESTING

a. Provide samples and test concrete for quality control during placement. Sampling of fresh concrete for testing shall be in accordance with ASTM C172/C172M.

b. Test concrete for compressive strength at 7 and 28 days for each design mix. Concrete test specimens shall conform to ASTM C31/C31M. Perform Compressive strength testing conforming to ASTM C39/C39M.

c. Test Slump at the site of discharge for each design mix in accordance with ASTM C143/C143M.

d. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or test extremely porous aggregates in accordance with ASTM C173/C173M.

e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M.

-- End of Section --

SECTION 04 20 00

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 530/530.1	(2011) Building Code Requirements and Specification for Masonry Structures and Related Commentaries
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A615/A615M	(2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A82/A82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C1019	(2011) Standard Test Method for Sampling and Testing Grout
ASTM C1072	(2010) Standard Test Method for Measurement of Masonry Flexural Bond Strength
ASTM C1142	(1995; R 2007) Standard Specification for Extended Life Mortar for Unit Masonry
ASTM C129	(2011) Standard Specification for Nonloadbearing Concrete Masonry Units

ASTM C144	(2011) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C207	(2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	(2010) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2010) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C593	(2006) Fly Ash and Other Pozzolans for Use with Lime for Soil Stabilization
ASTM C62	(2010) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C641	(2009) Staining Materials in Lightweight Concrete Aggregates
ASTM C652	(2010) Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C67	(2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C780	(2011) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C90	(2011a) Loadbearing Concrete Masonry Units
ASTM C91	(2005) Masonry Cement
ASTM C94/C94M	(2011a) Standard Specification for Ready-Mixed Concrete
ASTM C989	(2010) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D 2240	(2005; R 2010) Standard Test Method for Rubber Property - Durometer Hardness

ASTM D 2287 (1996; R 2010) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2009; Errata First Printing) International Building Code

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Not used

1.2.3 Not used

1.2.4 Design Requirements

1.2.4.1 Unit Strength Method

Compute compressive strength of masonry system "Unit Strength Method", ACI 530/530.1. Submit calculations and certifications of unit and mortar strength.

1.2.4.2 Seismic Requirement

In addition to design requirements of ICC IBC, provide additional seismic reinforcement as detailed on the drawings. The total minimum reinforcing percentage for structural walls shall be 0.20 percent and non-structural walls shall be 0.15 percent. The maximum spacing of reinforcing bars shall be as follows:

Wall Type	Vertical	Horizontal
Structural	24 inches	48 inches
Non-structural	48 inches	80 inches

Bond beams are required at the top of footings, at the bottom and top of openings at roof and floor levels, and at the top of parapet walls.

1.2.4.3 Masonry Strength

Determine masonry strength in accordance with ACI 530/530.1; submit test reports on three prisms as specified in ACI 530/530.1. The cost of testing shall be paid by the Contractor.

1.2.5 Additional Requirements

a. Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Cement
Brick
Insulation
Cold Weather Installation

SD-04 Samples

Brick
Anchors, Ties, and Bar Positioners

SD-05 Design Data

Pre-mixed Mortar
Unit Strength Method

SD-06 Test Reports

Efflorescence Test
Field Testing of Mortar
Field Testing of Grout
Prism tests
Masonry Cement

SD-07 Certificates

Concrete Masonry Units (CMU)

SD-08 Manufacturer's Instructions

Masonry Cement

1.4 QUALITY ASSURANCE

1.4.1 Appearance

Blend all CMU/brick to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable.

1.4.2 Detail Drawings

Submit detail drawings showing bar splice locations. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during

construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66. Submit drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, stored, handled, and protected to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.5.1 Masonry Units

Cover and protect moisture-controlled concrete masonry units and cementitious materials from precipitation. Conform to all handling and storage requirements of ASTM C90. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.5.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.5.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination or segregation.

1.6 PROJECT/SITE CONDITIONS

Conform to ACI 530/530.1 for hot and cold weather masonry erection.

1.6.1 Hot Weather Installation

Take the following precautions if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent or the ambient air temperature exceeds 90 degrees F and the wind velocity is more than 8 mph. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

1.6.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F or temperature of masonry units is below 40 degrees F, submit a written statement of proposed cold weather construction procedures for approval.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.Submit sample of colored mortar with applicable masonry unit and color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture. Submit test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2 CLAY OR SHALE BRICK

Submit brick samples as specified. Color range and texture of clay or shale brick shall be as indicated and shall conform to the approved sample. Brick shall conform to ASTM C62; Grade SW shall be used for brick in contact with earth or grade and for all exterior work and for all nonvertical surfaces. Average dimensions of brick shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long (standard) or 4 inches thick, 2-2/3 inches high, and 8 inches long (nominal), subject to the tolerances specified in ASTM C62. Brick shall be tested for efflorescence. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.1 Solid Clay or Shale Brick

Solid clay or shale brick shall conform to ASTM C62, Type FBX. Brick size shall be modular and the nominal size of the brick used shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long (nominal) or 4 inches thick, 2-2/3 inches high and 8 inches long (nominal). Minimum compressive strength of the brick shall be 2200 psi.

2.2.2 Hollow Clay or Shale Brick

Hollow clay or shale brick shall conform to ASTM C652, Type HBX. Brick size shall be modular and the nominal size of the brick used shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long. Where vertical reinforcement is shown in hollow brick, the minimum cell dimension shall be 2-1/2 inches and the units shall be designed to provide precise vertical alignment of the cells. Minimum compressive strength of the brick shall be 2200 psi.

2.4 CONCRETE MASONRY UNITS (CMU)

Submit samples and certificates as specified. Cement shall have a low alkali content and be of one brand. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Units may contain post-consumer or post-industrial recycled content. Units shall be of modular dimensions and air, water, or steam cured. Surfaces of units

which are to be plastered or stuccoed shall be sufficiently rough to provide bond; elsewhere, exposed surfaces of units shall be smooth and of uniform texture. Exterior concrete masonry units shall have water-repellant admixture added during manufacture.

a. Hollow Load-Bearing Units: ASTM C90, made with lightweight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Hollow Non-Load-Bearing Units: ASTM C129, made with lightweight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

c. Solid Load-Bearing Units: ASTM C90, lightweight units. Provide solid units as indicated.

2.4.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification. Use industrial waste by-products (air-cooled slag, cinders, or bottom ash), ground waste glass and concrete, granulated slag, and expanded slag in aggregates. Slag shall comply with ASTM C989; Grade 80.

2.5 MORTAR FOR STRUCTURAL MASONRY

ASTM C270, Type S. Strength (f'm) as indicated. Test in accordance with ASTM C780. Use Type I portland cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar and 18 percent in masonry cement mortar. Use up to 40 percent Class F fly ash with type IP cement in cement-lime mortar. Fly ash shall comply with ASTM C593.

2.6 MASONRY MORTAR

Mortar Type S shall conform to the proportion specification of ASTM C270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; Type N cement-lime mortar proportions shall be 1 part cement, 1 part lime and 6 parts aggregate. Type N or S mortar shall be used for non-load-bearing, non-shear-wall interior masonry; and Type S for remaining masonry work; except where higher compressive strength is indicated on structural drawings. When masonry cement ASTM C91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C780 and ASTM C1072. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.6.1 Admixtures for Masonry Mortar

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall

contain less than 0.2 percent chlorides, and shall conform to ASTM C494/C494M, Type C. Submit the required certifications.

2.6.2 Hydrated Lime and Alternates

Hydrated lime shall conform to ASTM C207, Type S.

2.6.3 Cement

Portland cement shall conform to ASTM C150/C150M, Type I, II, or III. Masonry cement shall conform to ASTM C91, Type NS. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar. Incorporate to the maximum extent, without conflicting with other requirements of this section, up to 40 percent fly ash, up to 70 percent slag, up to 10 percent cenospheres, and up to 10 percent silica fume. When masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required. Additives shall conform to requirements in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

2.6.4 Pre-Mixed Mortar

Pre-mixed mortar shall conform to ASTM C1142, Type RS. Submit pre-mixed mortar composition.

2.6.5 Sand and Water

Sand shall conform to ASTM C144. Water shall be clean, potable, and free from substances which could adversely affect the mortar.

2.7 WATER-REPELLANT ADMIXTURE

Polymeric type formulated to reduce porosity and water penetration and water absorption of the mortar and masonry units.

2.8 GROUT AND READY-MIXED GROUT

Grout shall conform to ASTM C476, fine . Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 11 inches. Minimum grout strength shall be 2000 psi in 28 days, as tested by ASTM C1019. Use grout subject to the limitations of Table III. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Ready-Mixed grout shall conform to ASTM C94/C94M.

2.8.1 Admixtures for Grout

In cold weather, a non-chloride based accelerating admixture may be used subject to approval; accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C494/C494M, Type C. In general, air-entrainment, anti-freeze or chloride admixtures shall not be used except as approved by the Contracting Officer. Submit required certifications.

2.8.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.9 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A153/A153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A82/A82M. Wire ties or anchors in exterior walls shall conform to ASTM A641/A641M. Joint reinforcement in interior walls, and in exterior or interior walls exposed to moist environment shall conform to ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face. Submit two anchors, ties and bar positioners of each type used, as samples.

2.9.1 Wall Ties

Provide wall ties rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.9.2 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.10 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A82/A82M, welded construction.Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A153/A153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

2.11 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A615/A615M, Grade 60.

2.12 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.13 RIGID BOARD-TYPE INSULATION

Provide rigid board-type insulation as specified in Section 07 21 13 BOARD AND BLOCK INSULATION. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires. Submit certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

2.14 EXPANSION-JOINT MATERIALS

Sealant shall conform to Section 07 92 00 JOINT SEALANTS.

2.15 THROUGH WALL FLASHING

Flashing shall be specified in Section 07 60 00 FLASHING AND SHEET METAL.

a. Coated-Copper Flashing: 7 ounce, electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, elastic bituminous compound. Factory apply coating to a weight of not less than 6 ounces/square foot (approximately 3 ounces/square foot on each side).

b. Copper or Stainless Steel Flashing: Copper, ASTM B370, minimum 16 ounce weight; stainless steel, ASTM A167, Type 301, 302, 304, or 316, 0.015 inch thick, No. 2D finish. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.

2.16 WEEP HOLE VENTILATORS

Weep hole ventilators shall be prefabricated aluminum, plastic or wood blocking sized to form the proper size opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance or insects. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 PREPARATION

Prior to start of work, masonry inspector shall verify the applicable conditions as set forth in ACI 530/530.1, inspection.

3.1.1 Protection

Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F

b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.1.3 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.1.4 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.1.5 Surfaces

Clean surfaces on which masonry is to be placed of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

3.2 LAYING MASONRY UNITS

a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic.

b. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb.

c. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

d. In double wythe construction, the inner wythe may be brought up not more than 16 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

3.2.1 Forms and Shores

Provide bracing and scaffolding as required. Design bracing to resist wind pressure as required by local codes. Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.2 Reinforced Concrete Masonry Units Walls

Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Clay or Shale Brick Units

Lay brick facing with the better face exposed. Lay brick in running bond with each course bonded at corners, unless otherwise indicated. Lay molded brick with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid. Test clay or shale brick daily on the job, prior to laying, as follows: Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks. Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested.

3.2.4.2 Solid Units

Completely fill bed, head, and collar joints with mortar.

3.2.4.3 Hollow Units

Lay hollow units as specified for concrete masonry units.

3.2.4.4 Brick-Faced Walls

For brick-faced walls bond the two wythes in every sixth brick course with continuous horizontal joint reinforcement. Provide additional bonding ties spaced not more than 3 feet apart around the perimeter of and within 12 inches of all openings.

a. Collar Joints: Fill collar joints solid with mortar as each course of brick is laid. Do not disturb units in place.

b. Brick Sills: Lay brick on edge, slope, and project not less than 1/2 inch beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

3.2.4.5 Cavity Walls

Provide a continuous cavity as indicated. Securely tie the two wythes together with horizontal joint reinforcement. Bevel mortar beds away from cavity to prevent projection into cavity when bricks are shoved in place. Keep cavities clear and clean of mortar droppings. At the bottom of cavity walls, in the course immediately above the through-wall flashing, temporarily omit one brick every 4 feet. With a hose and clean water, wash all mortar droppings and debris out of the cavity through the temporary openings at least twice each day masonry is laid, and more often when required to keep the cavities clean. Fill in the openings with bricks and mortar after the wall is complete and the cavity has been inspected and found clean. Provide weep holes of open head joints spaced 24 inches o.c. wherever the cavity is interrupted and at base of wall and vertical obstructions (e.g. lintels).

3.2.5 Tolerances

Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Square corners unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, lay masonry within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

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In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation from level for bed joints and top surfaces of bearing walls

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In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of columns and in thickness of walls

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Minus	1/4 inch
Plus	1/2 inch

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.9 Embedded Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout.

3.2.10 Unfinished Work

Step back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved by the COR. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.2.11 Masonry Wall Intersections

Masonry bond each course at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond

beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.3 WEEP HOLES

Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated on drawings. Weep holes shall be open head joints. at 24 inches o.c. Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be perfectly horizontal or slightly canted downward to encourage water drainage outward and not inward. Weep holes shall be constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.4 MORTAR MIX

Mix mortar in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measure ingredients for mortar by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Mix water with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Retemper mortar that has stiffened because of loss of water through evaporation by adding water to restore the proper consistency and workability. Discard mortar that has reached its initial set or that has not been used within 2.5 hours after mixing.

3.5 REINFORCING STEEL

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.5.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.5.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.6 JOINT REINFORCEMENT INSTALLATION

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

3.7 PLACING GROUT

Fill cells containing reinforcing bars with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.7.1 Vertical Grout Barriers for Fully Grouted Walls

Provide grout barriers not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.7.2 Horizontal Grout Barriers

Embed grout barriers in mortar below cells of hollow units receiving grout.

3.7.3 Grout Holes and Cleanouts

3.7.3.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 16 inches on centers where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

3.7.3.2 Cleanouts for Hollow Unit Masonry Construction

Provide cleanout holes at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be

exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.7.3.3 Cleanouts for Solid Unit Masonry Construction

Provide cleanouts for construction of walls consisting of a grout filled cavity between solid masonry wythes at the bottom of every pour by omitting every other masonry unit from one wythe. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Do not plug cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.7.4 Grouting Equipment

3.7.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Operate pumps to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.7.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. Maintain at least one spare vibrator at the site at all times. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

3.7.5 Grout Placement

Lay masonry to the top of a pour before placing grout. Do no place grout in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.7.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours

that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.7.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses.Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

(1) The actual grout space or cell dimension shall be larger than the sum of the following items:

a) The required minimum dimensions of total clear areas given in the table above;

b) The width of any mortar projections within the space;

c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.8 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.9 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using mortar to fill the head joint in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07 92 00 JOINT SEALANTS. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.10 SHELF ANGLES

Adjust shelf angles as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized and provided in sections not longer than 10 feet and installed with a 1/4 inch gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.

3.11 LINTELS

3.11.1 Precast Concrete and Steel Lintels

Construct precast concrete and steel lintels as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true.

Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.12 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.12.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.12.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.13 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.14 NOT USED

3.15 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs or splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.15.1 Dry-Brushing

a. Exposed concrete masonry unit

b. Exposed concrete brick surfaces

c. Shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.15.2 Clay or Shale Brick Surfaces

Clean exposed clay or shale brick masonry surfaces as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, examine the sample panel of similar material for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, change the method of cleaning to ensure that the masonry surfaces in the structure will not be adversely affected.The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.16 BEARING PLATES

Set bearing plates for beams, joists, joist girders and similar structural members to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated.

3.17 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.18 NOT USED

3.19 TEST REPORTS

3.19.1 Field Testing of Mortar

Take at least three specimens of mortar each day. Spread a layer of mortar 1/2 to 5/8 inch thick on the masonry units and allowed to stand for one minute. Prepare and test the specimens for compressive strength in accordance with ASTM C780. Submit test results.

3.19.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days. Submit test results.

-- End of Section --

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 201	(2006) AISC Certification Program for Structural Steel Fabricators
AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2011) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 810	(1997) Design Guide 10: Erection Bracing of Low-Rise Structural Steel Buildings
ANSI/AISC 341	(2005; Suppl No. 1 2005) Seismic Provisions for Structural Steel Buildings
ANSI/AISC 360	(2010) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2007) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A490	(2010ae1) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2007a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2007) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2011) Standard Specification for Structural Steel Shapes
ASTM B695	(2004; R 2009) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C1107/C1107M	(2011) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C827/C827M	(2010) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
ASTM F 1554	(2007ae1) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F 436	(2011) Hardened Steel Washers
ASTM F 844	(2007a) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(2009) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel
SSPC PS 13.01	(1982; E 2004) Epoxy Polyamide Painting System
SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.756	Steel Erection; Beams and Columns

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer and galvanizing, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with ANSI/AISC 360 and ANSI/AISC 341 except as modified in this contract.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection Plan, including description of temporary supports;

Fabrication drawings including description of connections;

SD-03 Product Data

Shop primer

Welding electrodes and rods

Load indicator washers

Non-Shrink Grout

Include test report for Class B primer.

SD-06 Test Reports

Class B coating

Bolts, nuts, and washers

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel

Bolts, nuts, and washers

Galvanizing

Welding procedures and qualifications

1.4 QUALITY ASSURANCE

1.4.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Fabrication drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Double connections that require an erection seat to comply with OSHA 29 CFR 1926.756(c)(1) shall be shown on the shop drawings, reviewed and approved by the structural engineer of record. Use AWS A2.4 standard welding symbols. Member substitutions of details shown on the contract drawings shall be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.4.2 Certifications

1.4.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing.

1.4.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

Conform to all requirements specified in AWS D1.1/D1.1M.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Steel

ASTM A36/A36M.

2.1.2 High-Strength Structural Steel

2.1.2.1 Low-Alloy Steel

ASTM A572/A572M , Grade 50. ASTM A992/A992M Grade 50.

2.1.3 Structural Shapes for Use in Building Framing

Wide flange shapes, ASTM A992/A992M.

2.1.4 Structural Steel Tubing

ASTM A500/A500M, Grade B.

2.1.5 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B, weight class STD (Standard).

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel, Steel Pipe

2.2.1.1 Bolts

ASTM A307, Grade A; ASTM A325, Type 1. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F 844 washers for ASTM A307 bolts, and ASTM F 436 washers for ASTM A325 and ASTM A490 bolts.

2.2.2 High-Strength Structural Steel and Structural Steel Tubing

2.2.2.1 Bolts

ASTM A325, Type 1.

2.2.2.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

2.2.2.3 Washers

ASTM F 436, plain carbon steel.

2.2.3 Foundation Anchorage

2.2.3.1 Anchor Bolts

Galvanized ASTM F 1554.

2.2.3.2 Anchor Nuts

Galvanized ASTM A563, Grade A, hex style.

2.2.3.3 Anchor Washers

Galvanized ASTM F 844.

2.2.3.4 Anchor Plate Washers

ASTM A36/A36M.

2.2.4 Load Indicator Washers

ASTM F 959. Provide ASTM B695, Class 50, Type 1 galvanizing.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.3.2 Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage. Grout shall be nonmetallic.

2.3.3 Welded Shear Stud Connectors

AWS D1.1/D1.1M.

2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC 325 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 GALVANIZING

ASTM A123/A123M or ASTM A153/A153M, as applicable, unless specified otherwise galvanize after fabrication where practicable.

2.6 FABRICATION

2.6.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded or on surfaces of weathering steels that will be exposed in the completed structure. Do not locate match

markings in areas that will decrease member strength or cause stress concentrations. Affix embossed tags to hot-dipped galvanized members.

2.6.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.6.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.6.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

2.7 DRAINAGE HOLES

Adequate drainage holes shall be drilled to eliminate water traps. Hole diameter shall be 1/2 inch and location shall be indicated on the detail drawings. Hole size and location shall not affect the structural integrity.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 325. Fabrication and assembly shall be done in the shop to the greatest extent possible.

Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC 201 and primed with the specified paint.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

3.2 INSTALLATION

3.3 ERECTION

a. Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC 325. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.

b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC 303 and the structure shall be erected in accordance with AISC 810.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.3.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.4 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with ANSI/AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member. Holes shall not be cut or enlarged by burning. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.4.1 Common Grade Bolts

ASTM A307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.4.2 High-Strength Bolts

ASTM A325 and ASTM A490 bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.4.2.1 Installation of Load Indicator Washers (LIW)

ASTM F 959. Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F 436 washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening. In addition to the LIW, provide flat ASTM F 436 washers under both the bolt head and nut when ASTM A490 bolts are used.

3.5 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

3.6 WELDING

AWS D1.1/D1.1M. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

The Contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.6.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.7 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.7.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.8 GALVANIZING REPAIR

Provide as indicated or specified. Galvanize after fabrication where practicable. Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

3.9 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 2 working days of the date of weld inspection.

3.9.1 Welds

3.9.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification

inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

Inspection by the Government will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use.

3.9.1.2 Nondestructive Testing

AWS D1.1/D1.1M. Test locations shall be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

3.9.2 Load Indicator Washers

3.9.2.1 Load Indicator Washer Compression

Load indicator washers shall be tested in place to verify that they have been compressed sufficiently to provide the 0.015 inch gap when the load indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.005 inch gap when the load indicator washer is placed under the turned element, as required by ASTM F 959.

3.9.3 High-Strength Bolts

3.9.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in ANSI/AISC 360, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

3.9.3.2 Inspection

Inspection procedures shall be in accordance with ANSI/AISC 360. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

-- End of Section --

SECTION 05 21 19

OPEN WEB STEEL JOIST FRAMING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS B2.1	(2005; Errata 2006; Errata 2006) Welding Procedure and Performance Qualification
AWS D1.1/D1.1M	(2006; Errata 2006) Structural Welding Code - Steel

STEEL JOIST INSTITUTE (SJI)

SJI 279167 SPECS/LOADS	(2006) 42nd Edition Standard Specifications and Load Tables for Steel Joists and Joist Girders
SJI MANUAL	(2003) 75 Year Manual, 1928-2003
SJI TD 10	(2003) Technical Digest for the Design of Fire Resistive Assemblies with Steel Joists
SJI TD 8	(1983) Technical Digest for the Welding of Open Web Steel Joists
SJI TD 9	(2006) Technical Digest for the Handling and Erection of Steel Joists and Joist Girders

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 14.01	(1982; E 2004) Steel Joist Shop Painting System
SSPC Paint 15	(1999; R 2004) Steel Joist Shop Primer/Metal Building Primer

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1200	Hazard Communication
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.757	Steel Erection; Open Web Steel Joists

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welder qualification;

SD-02 Shop Drawings

Steel joist framing;

SD-06 Test Reports

Erection inspection

Welding inspections

SD-07 Certificates

Accessories

Certification of Compliance

1.3 REGULATORY REQUIREMENT

All joist girder framing must conform to 29 CFR 1926.757. Secure all joist bridging and anchoring in place prior to the application of any construction loads. Distribute temporary loads so that joist capacity is not exceeded. Do not apply loads to bridging.

1.4 DELIVERY AND STORAGE

Handle, transport, and store joists in a manner to prevent damage affecting their structural integrity. Store all items off the ground in a well drained location protected from the weather and easily accessible for inspection and handling.

1.5 QUALITY ASSURANCE

All work must comply with the requirements set forth in 29 CFR 1926.

1.5.1 Drawing Requirements

Submit steel joist framing drawings. Show joist type and size, layout in plan, and erection details including methods of anchoring, framing at openings, type and spacing of bridging, and details of accessories as applicable.

1.5.2 Certification of Compliance

Prior to construction commencement, submit Material Safety Data Sheet per 29 CFR 1910.1200 for steel joists , and certification for welder qualification, compliance with AWS B2.1, welding operation, and tacker, stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

Submit certification of compliance for the following:

SJI MANUAL
SJI TD 8
SJI TD 9
SJI TD 10
29 CFR 1926
29 CFR 1926.757

PART 2 PRODUCTS

2.1 JOISTS AND ACCESSORIES

Provide design data from SJI 279167 SPECS/LOADS for the joist series indicated.

2.2 PAINTING

2.2.1 Shop Painting

Clean and prime joists in accordance with SSPC Paint 15 and SSPC PS 14.01, Steel Joist Shop Painting System, using only Type I, "Red Oxide Paint."

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Handling and Erection

Conform to SJI 279167 SPECS/LOADS for the joist series indicated.

3.1.2 Welding

All welding must conform to AWS B2.1 and AWS D1.1/D1.1M.

3.2 BEARING PLATES

Provide bearing plates to accept full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate must be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout must be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.3 PAINTING

3.3.1 Touch-Up Painting

After erection of joists, touch-up connections and areas of abraded shop coat with paint of the same type used for the shop coat.

3.3.2 Field Painting

Paint joists requiring a finish coat in conformance with the requirements of Section 09 90 00 PAINTING AND COATING.

3.4 VISUAL INSPECTIONS

3.4.1 Erection Inspection

AWS D1.1/D1.1M, Section 6. Perform erection inspection and field welding inspections with AWS certified welding inspectors. Welding inspectors must visually inspect and mark welds.

-- End of Section --

SECTION 05 30 00

STEEL DECKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100	(1991; R 2008) Cold-Formed Steel Design Manual
AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

FM GLOBAL (FM)

FM DS 1-28	(2002) Design Wind Loads

STEEL DECK INSTITUTE (SDI)

SDI 31	(2007) Design Manual for Composite Decks, Form Decks, and Roof Decks
SDI DDMO3	(2004; Errata 2006; Add 2006) Diaphragm Design Manual; 3rd Edition
SDI DDP	(1987; R 2000) Deck Damage and Penetrations
SDI MOC2	(2006) Manual of Construction with Steel Deck

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20	(2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2010) Structural Engineering

UNDERWRITERS LABORATORIES (UL)

UL 209	(2005; Reprint May 2007) Cellular Metal Floor Raceways and Fittings
UL 580	(2006; Reprint Jul 2009) Tests for Uplift Resistance of Roof Assemblies

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

SD-03 Product Data

Accessories

Galvanizing Repair Paint

Joint Sealant Material

Mechanical Fasteners

Repair Paint

Welder Qualifications

Welding Equipment

Welding Rods and Accessories

SD-07 Certificates

Welding Procedures

Wind Storm Resistance

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide manufacturer's certificates attesting that the decking material meets the specified requirements.

1.3.2 Qualifications for Welding Work

Follows Welding Procedures in accordance with AWS D1.1/D1.1M.

Submit qualified Welder Qualifications in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories.

1.3.3 Regulatory Requirements

1.3.3.1 Wind Storm Resistance

Provide roof construction assembly capable of withstanding an uplift pressure of 90 pounds per square foot when tested in accordance with the uplift pressure test described in the FM DS 1-28 or as described in UL 580 and in general compliance with UFC 3-301-01.

1.3.4 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated

covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of AISI D100.

1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Sheet

Flat rolled carbon steel sheets of structural quality, thickness not less than indicated before coating, meeting the requirements of AISI SG03-3, except as modified herein.

2.1.2 Steel Coating

ASTM A653/A653M designation 2180 G60 galvanized, or ASTM A792/A792M designation AZ55, aluminum-zinc alloy. Apply coating to both sides of sheet. Conform to UL 209 for coating on decking provided as wire raceways.

2.1.3 Mixes

2.1.3.1 Galvanizing Repair Paint for all Decks

Provide a high-zinc-dust content paint for regalvanizing welds in galvanized steel conforming to ASTM A780/A780M.

2.1.4 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to ASTM A36/A36M, merchant quality, Grade Designation SAE/AISI 1023 or SAE/AISI 1025, and hot-dip galvanized in accordance with ASTM A123/A123M.

2.1.5 Joint Sealant Material for Roof Decks

Provide a nonskinning, gun-grade, bulk compound material as recommended by the manufacturer.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.028 inch thick to close open ends at end walls, and openings through deck.

2.2.3 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.2.4 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated or pneumatically driven fasteners, for anchoring the deck to structural supports and adjoining units that are designed to meet the loads indicated. Provide positive locking-type fasteners listed by the Steel Deck Institute and ICC-ES, as approved by the Contracting Officer.

2.2.5 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0295 inch other metal accessories, 0.0358 inch unless otherwise indicated. Accessories must include but not be limited to saddles, welding washers, fasteners, underlapping sleeves.

2.3 FABRICATION

2.3.1 Roof Deck

Conform to ASTM A792/A792M or ASTM A1008/A1008M for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of the steel design thickness required by the design drawings and galvanized.

2.3.1.1 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal 0.0359 inch thick before galvanizing. Bend strips to form a 45-degree cant not less than 5 inch wide, with top and bottom flanges a minimum 3 inch wide. Length of strips 10 feet.

2.3.1.2 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0359 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

2.3.2 Form Deck

Conform to ASTM A653/A653M or ASTM A1008/A1008M. Fabricate form deck of the steel design thickness required by the design drawings. Zinc-coat in conformance with ASTM A653/A653M, G60 coating class.

2.3.3 Touch-Up Paint

Provide touch-up paint for zinc-coated units of an approved galvanizing repair paint with a high-zinc dust content. Touch-up welds with paint conforming to SSPC Paint 20 in accordance with ASTM A780/A780M. Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

For floor decking installation, wire brush, clean, and touchup paint the scarred areas on the top and bottom surfaces of the metal floor decking and on the surface of supporting steel members. Include welds, weld scars, bruises, and rust spots for scarred areas. Touched up the galvanized surfaces with galvanizing repair paint. Touch up the painted surfaces with paint for the repair of painted surfaces.

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with SDI DDMO3 and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical.Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 5/8 inch diameter puddle welds or fastened with screws, powder-actuated fasteners, or pneumatically driven fasteners as indicated on the design drawings and in accordance with manufacturer's recommended procedure and SDI 31. Clamp or weight deck units

to provide firm contact between deck units and structural supports while performing welding or fastening. Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Welding

Perform welding in accordance with AWS D1.3/D1.3M using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in AWS D1.1/D1.1M and AWS D1.3/D1.3M make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. Conform to the recommendations of the Steel Deck Institute and the steel deck manufacturer for location, size, and spacing of fastening. Do not use welding washers at the connections of the deck to supports. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Lap 2 inch deck ends. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of SDI DDMO3. Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of coated finish with zinc-dust paint conforming to ASTM A780/A780M.

3.2.1.2 Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners as listed by the Steel Deck Institute, ICC-ES, the fastener and steel deck manufacturers, and approved by the Contracting Officer. Drive the powder-actuated fasteners with a low-velocity piston tool by an operator authorized by the manufacturer of the powder-actuated tool. Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations.

3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP.Reinforce holes and openings 6 to 12 inch across by 0.0474 inch thick steel sheet at least 12 inch wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inch on center. Reinforce holes and openings larger than 12 inch by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists.

3.2.3 Deck Damage

SDI MOC2, for repair of deck damage.

3.2.4 Accessory Installation

3.2.4.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.2.5 Concrete Work

Prior to placement of concrete, inspect installed decking to ensure that there has been no permanent deflection or other damage to decking. Replace decking which has been damaged or permanently deflected as approved by the Contracting Officer. Place concrete on metal deck in accordance with Construction Practice of SDI 31.

3.3 JOINT SEALING FOR ROOF DECKS

Seal sidelaps and endlaps with manufacturer's recommended joint sealing material. Shop or field apply the material. Before applying the sealing material, completely remove dust, dirt, moisture, and other foreign material from the surfaces to which the sealing material is to be applied. Apply sealing material in strict accordance with the sealing material manufacturer's printed instructions.

3.4 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

3.5 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

3.6 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.7 FIELD QUALITY CONTROL

3.7.1 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges is 1/16 inch; when gap is more than 1/16 inch, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

-- End of Section --

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG02-KIT	(2001; Supp 1 2004) North American Specification for the Design of Cold-Formed Steel Structural Members
AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M	(2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A370	(2011) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1513	(2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM C955	(2011b) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM E329	(2011b) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

ASTM F 1941	(2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
ASTM F 1941M	(2007) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Metric)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components;

a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.

b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.

c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

SD-03 Product Data

Steel studs,joists, tracks, bracing, bridging and accessories

SD-05 Design Data

Metal framing calculations;

SD-07 Certificates

Welds

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Finish of the framing members shall be

maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust. Replace damaged items with new, as directed by the Contracting Officer.

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI SG03-3.

1.5 MAXIMUM DEFLECTION

a. Floor Joists:

L/360 - Live load only
L/240 - Total load

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit framing components to show sizes, thicknesses, layout, material designations, methods of installation, and accessories.

1.6.2 Design Data Required

Submit metal framing calculations to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation. Submit metal framing calculations for any connections, member sizes, or anchorage that deviates from the drawings, provide structural analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

PART 2 PRODUCTS

2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with ASTM C955 and the following.

2.1.1 Studs and Joists of 16 Gage (0.0598 Inch) and Heavier

Galvanized steel, ASTM A653/A653M, SS Grade 50, G60.

2.1.2 Studs and Joists of 18 Gage (0.0478 Inch) and Lighter

Studs and Joists of 18 Gage (0.0478 Inch) and Lighter, Track, and Accessories (All Gages): Galvanized steel, ASTM A653/A653M, SS, Grade 50 33,000 psi G60.

2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Size and gage as indicated. Steel stud deflection shall be limited to L/600 for exterior wall brick veneer construction.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

a. An ICC number.

b. Manufacturer's identification.

c. Minimum delivered uncoated steel thickness.

d. Protective coating designator.

e. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling, tapping screws in compliance with ASTM C1513 of the type, size and location as shown on the drawings. Electroplated screws shall have a minimum 5 micron zinc coating in accordance with ASTM F 1941. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M as appropriate.

2.4 PAINT

Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with corrosion-inhibiting primer, SSPC Paint 25.

2.5 PLASTIC GROMMETS

Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires. Prevent metal to metal contact for plumbing pipes.

PART 3 EXECUTION

3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.1.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI SG02-KIT. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 18 gage.

3.1.2 Screws

Screws shall be self-drilling self-tapping type, size, and location shown on the drawings. Screw penetration through joined materials shall not be less

than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-KIT. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

3.1.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location shown on the drawings.

3.2 INSTALLATION

3.2.1 Tracks

Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 3 inches from the edge of concrete slabs.

3.2.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 2 feet wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI SG03-3, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

LOAD	HEIGHT	BRACING
Axial load	Up to 3000 mm 10 feet	Two rows at 1/3 points
	Over 3000 mm 10 feet	Rows 900 mm 3'-4" o.c. maximum

3.2.3 Joists

Locate each joist directly above a stud. Provide doubled joists under parallel partitions wherever partition length exceeds 1/2 of joist span. Joists shall have at least 2.50 inches of bearing on steel, 4 inches on masonry, and shall be reinforced over bearings where required to prevent web crippling. Splice joists over bearings only. Lap and weld splices as indicated. Provide manufacturer's standard bridging which shall not be less than the following:

CLEAR SPAN	BRIDGING
Up to 4200 mm 14 feet	One row near center
4200 mm to 6000 mm 14 to 20 feet	Two rows at 1/3 points
6000 mm to 7800 mm 20 to 26 feet	Three rows at 1/4 points
7800 mm to 10600 mm 26 to 32 feet	Four rows at 1/5 points

Temporary bracing shall be provided and remain in place until work is permanently stabilized.

3.2.4 Erection Tolerances

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

(1) Layout of walls and partitions: 1/4 inch from intended position;

(2) Plates and runners: 1/4 inch in 8 feet from a straight line;

(3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 1/4 inch in 8 feet from a true plane.

b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

(1) Layout of walls and partitions: 1/4 inch from intended position;

(2) Plates and runners: 1/8 inch in 8 feet from a straight line;

(3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.3	(2006) Operations - Safety Requirements for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.21.1	(2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.6.2	(1998; R 2010) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series
ASME B18.6.3	(2010) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A467/A467M	(2007) Standard Specification for Machine Coil Chain
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B108/B108M	(2008) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B26/B26M	(2009) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C1513	(2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; R 2011e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

ASTM E488 (1996; R 2003) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Embedded angles and plates, installation drawings;

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A36/A36M.

2.1.2 Structural Tubing

ASTM A500/A500M.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.1.5 Anchor Bolts

ASTM A307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.5.1 Post Installed Anchors

Provide diameter as indicated on drawings. Minimum embedment shall be per manufacturer's requirements. Design values listed shall be as tested according to ASTM E488.

a. Minimum allowable pullout value shall be as indicated on drawings.

b. Minimum allowable shear value shall be as indicated on drawings.

2.1.5.2 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

2.1.5.3 Toggle Bolts

ASME B18.2.1.

2.1.5.4 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 or ASTM A307.

2.1.5.5 Powder Actuated Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

2.1.5.6 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.1.5.7 Washers

Provide plain washers to conform to ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.1.

2.1.6 Aluminum Alloy Products

Conform to ASTM B209 for sheet plate, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, 2180 G60, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with a standard mill finish. Provide a coating thickness not less than that specified for protective and decorative

type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45. Provide a polished satin finish on items to be anodized.

2.3 GUARD POSTS (BOLLARDS/PIPE GUARDS)

Provide 8 inch galvanized standard weight steel pipe as specified in ASTM A53/A53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.4 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 inches bearing on masonry at each end.

Provide angles and plates, ASTM A36/A36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A123/A123M.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.6 FINISHES

3.6.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

3.6.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.6.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

-- End of Section --

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20	(2010) American Softwood Lumber Standard

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Eng Man	(2010) Manual for Railway Engineering

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E445	(2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
APA F405	(1999) Performance Rated Panels
APA L870	(2010) Voluntary Product Standard, PS 1-09, Structural Plywood
APA S350	(2011) Performance Standard for Wood-Based Structural-Use Panels

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts
ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM D3498	(2011) Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
ASTM D6007	(2002; R 2008) Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber
ASTM E1333	(2010) Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

FOREST STEWARDSHIP COUNCIL (FSC)

FSC-STD-01-001	(1993; R 2002) FSC Principles and Criteria (version 4-0) EN

GREEN SEAL (GS)

GS-36	(2000) Green Seal Standard, Adhesives for Commercial Use

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2007) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2006) Standard Grading Rules for Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec	(1986; Supple. No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2002) Standard Grading Rules for Southern Pine Lumber

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS56	(1973) Structural Glued Laminated Timber

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923	(Rev A; Notice 2) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 2) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors
CID A-A-1925	(Rev A; Notice 2) Shield Expansion (Nail Anchors)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(1998) Western Lumber Grading Rules

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Modifications of structural members;

Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

1.4.2 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870.Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

1.4.3 Structural-Use and OSB Panels

Mark each panel with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the panel. The mark shall indicate end use, span rating, and exposure durability classification. Oriented Strand Board (OSB), APA F405.

1.5 SIZES AND SURFACING

ALSC PS 20 for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

a. Framing lumber and board, 19 percent maximum

b. Materials other than lumber; moisture content shall be in accordance with standard under which the product is produced

1.7 QUALITY ASSURANCE

1.7.1 Drawing Requirements

For fabricated structural members, trusses, qlue-lam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.2 Data Required

Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.3 Certificates of Grade

Submit certificates attesting that products meet the grade requirements specified in lieu of grade markings where appearance is important and grade marks will deface material.

1.7.4 Humidity Requirements

Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

1.8 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible. Lumber shall be FSC-certified.

2.1.2 Engineered Wood Products

Products shall be FSC-certified and shall contain no added urea-formaldehyde if exposed to interior spaces. Determine formaldehyde concentrations in air from engineered wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or ASTM E1333. Products shall not be used if formaldehyde concentration is found to be greater than 0.

2.2 LUMBER

2.2.1 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed. Finger-jointed lumber may be used in the same applications as solid lumber of an equivalent species and grade, provided the finger-jointed lumber meets all the requirements of the certification and the quality control programs of the rules writing agency having jurisdiction and all applicable requirements of DOC/NIST PS56.

Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common

NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.3 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS

APA L870, APA S350, APA E445, and APA F405 respectively.

2.3.1 Wall Sheathing

2.3.1.1 Plywood

C-D Grade, Exposure 1, and a minimum thickness of 1/2 inch , except where indicated to have greater thickness. FSC-certified.

2.3.1.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1, Span Rating of 16/0 or greater. OSB, APA Rated Sheathing. OSB shall be a phenolic-glued, low-formaldehyde board. FSC-certified.

2.3.2 Other Uses

2.3.2.1 Plywood

Plywood for casework. Plywood shall be FSC-certified.

2.3.2.2 Structural-Use and OSB Panels

Structural-use and OSB panels for casework. Panels shall be FSC-certified.

2.4 OTHER MATERIALS

2.4.1 Miscellaneous Wood Members

2.4.1.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm inch
Bridging	25 x 75 1 x 3 or 25 x 100 1 x 4 for use between members 50 x 300 2 x 12 and smaller; 50 x 100 2 x 4 for use between members larger than 50 x 300 2 x 12.
Corner bracing	25 x 100 1 x 4.
Furring	25 x [50] [75] 1 x 2
Grounds	Plaster thickness by 38.
Nailing strips	25 x 75 1 x 3 or 25 x 100 1 x 4 when used as shingle base or interior finish, otherwise 50 mm 2 inch stock.

2.4.1.2 Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

2.4.1.3 Blocking

Blocking shall be standard or number 2 grade.

2.4.2 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials, GS-36, SCAQMD Rule 1168, and as specified. Use water-based adhesives with maximum VOC content of 15 grams/liter for all interior applications. Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of LEED low emitting materials credit.

2.5 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Fasteners shall be fabricated from 100 percent re-melted steel.See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Fasteners may contain post-consumer or post-industrial recycled content. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip zinc-coated in accordance with ASTM A153/A153M.

2.5.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.5.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.5.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices shall be 3/8 inch.

2.5.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.5.5 Wood Screws

ASME B18.6.1.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Sills

3.1.1.1 Anchors in Masonry

Except where indicated otherwise, Embed anchor bolts not less than 15 inches in masonry unit walls and provide each with a nut and a 2 inch diameter washer at bottom end. Fully grout bolts with mortar.

3.1.1.2 Anchors in Concrete

Except where indicated otherwise, Embed anchor bolts not less than 8 inches in poured concrete walls and provide each with a nut and a 2 inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend shall be not less than 90 degrees. Powder-actuated fasteners spaced 3 feet o.c. may be provided in lieu of bolts for single thickness plates on concrete.

3.1.2 Subflooring

3.1.2.1 Plywood, Structural-Use, and OSB Panels

Apply best side up with the grain of outer plies or the long dimension at right angles to joists. Stagger end joints and locate over the centerline of joists. Support panel edges by nominal 2 by 4 members framed between joists so the edge joints of subfloor occur over the centerline of blocking. Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Panels shall be continuous over two or more spans. Nail panels 6 inches o.c. at supported edges and 10 inches o.c. over intermediate bearing. Nails shall be 8-penny common or 6-penny threaded. Provide at least 1/2 inch clearance between subflooring and masonry or concrete walls. Subflooring may be installed with adhesive conforming to ASTM D3498 and nails spaced at 12 inches on center unless otherwise shown.

3.1.3 Wall Sheathing

3.1.3.1 Plywood, Structural-Use, and OSB Panel Wall Sheathing

Apply horizontally or vertically. Extend sheathing over and nail to sill and top plate. Abut sheathing edges over centerlines of supports. Allow 1/8 inch spacing between panels and 1/8 inch at windows and doors. If sheathing is applied horizontally, stagger vertical end joints. Nail panels with 6-penny nails spaced 6 inches o.c. along edges of the panel and 12 inches o.c. over intermediate supports. Keep nails 3/8 inches away from panel ledges. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

3.1.4 Wood Sheathing

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width.

-- End of Section --

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20	(2010) American Softwood Lumber Standard

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M2	(2007) Standard for Inspection of Treated Wood Products
AWPA M4	(2002) Standard for the Care of Preservative-Treated Wood Products
AWPA P5	(2009) Standard for Waterborne Preservatives

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA PS 1	(1995) Voluntary Product Standard for Construction and Industrial Plywood

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(8th Edition) AWI Quality Standards

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM F 547	(2006) Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	(2010) Cabinet Hardware

FOREST STEWARDSHIP COUNCIL (FSC)

FSC-STD-01-001	(1993; R 2002) FSC Principles and Criteria (version 4-0) EN

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

HPVA HP-1	(2009) American National Standard for Hardwood and Decorative Plywood

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2007) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2006) Standard Grading Rules for Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2002) Standard Grading Rules for Southern Pine Lumber

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS58	(1973) Basic Hardboard (ANSI A135.4)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(1998) Western Lumber Grading Rules

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 4	(2009) Water-Repellent Preservative Non-Pressure Treatment for Millwork

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Submit documentation verifying that no urea-formaldehyde resins were used.

SD-07 Certificates

Certificates of grade

Certificates of compliance

1.3 DETAIL DRAWINGS

The Contractor shall submit detail drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

1.4 CERTIFICATES

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC-STD-01-001 and identify certifying organization.

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

Provide certificates of compliance unless materials bear certification markings or statements.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver lumber, plywood, trim, and millwork to job site in an undamaged condition. Stack materials to ensure ventilation and drainage. Protect against dampness before and after delivery. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity. Do not store products in building until wet trade materials are dry.

1.6 QUALITY ASSURANCE

1.6.1 Lumber

Identify each piece or each bundle of lumber, millwork, and trim by the grade mark of a recognized association or independent inspection agency that

is certified by the Board of Review, American Lumber Standards Committee, to grade the species.

1.6.2 Plywood

Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of the plywood. Mark shall identify plywood by species group or span rating, and shall show exposure durability classification, grade, and compliance with APA PS 1.

1.6.3 Hardboard and Particleboard

Materials shall bear a marking or statement identifying the producer and the applicable standard.

1.6.4 Pressure-Treated Lumber and Plywood

Each treated piece shall be inspected in accordance with AWPA M2.

1.6.5 Nonpressure-Treated Woodwork and Millwork

Mark, stamp, or label, indicating compliance with WDMA I.S. 4.

PART 2 PRODUCTS

2.1 WOOD

2.1.1 Sizes and Patterns of Wood Products

Yard and board lumber sizes shall conform to ALSC PS 20. Provide shaped lumber and millwork in the patterns indicated and standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the applicable standard.

2.1.2 Trim, Finish, and Frames

Provide species and grades listed for materials to be paint finished. Provide materials that are to be stain, natural, or transparent finished one grade higher than that listed. Provide species indicated for materials to be transparent finished. Run trim, except window stools and aprons with hollow backs.

TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH

Grading Rules	Species	Interior Trim, Finish, and Frames
WWPA G-5 grading rules	Aspen Douglas Fir-Larch Douglas Fir-South Engelmann Spruce -Lodgepole Pine Engelmann Spruce Hem-Fir Idaho White Pine	All Species: C & Btr. Select (Choice & Btr Idaho White Pine) or Superior Finish. Western Red Cedar may be graded C & Btr. Select or A & Btr. per Special Western Red Cedar

	Lodgepole Pine Mountain Hemlock Mountain Hemlock -Hem-Fir Ponderosa Pine- Sugar Pine (Ponderosa Pine -Lodgepole Pine) White Woods (Western Woods) Western Cedars Western Hemlock	Rules.
WCLIB 17 standard grading rules	Douglas Fir-Larch Hem-Fir Mountain Hemlock Sitka Spruce Western Cedars Western Hemlock	All Species: C & Btr VG, except A for Western Red Cedar
SPIB 1003 grading rules	Southern Pine	C & Btr
NHLA Rules	Cypress	C-Select
NELMA Grading Rules standard grading rules	Balsam Fir Eastern Hemlock- Tamarack Eastern Spruce Eastern White Pine Norway Pine Northern Pine Northern White Cedar	All Species: C-Select except C & Btr for Eastern White Pine and Norway Pine
RIS Grade Use standard specifications	Redwood	Clear Clear All Heart
NHLA Rules rules	Cypress	B Finish
	Red Gum Soft Elm Birch	Select or Btr (for interior use only)

2.1.3 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA G-5, 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

2.1.4 Softwood Plywood

APA PS 1, thicknesses as indicated.

a. Plywood for Shelving: Interior type, A-B Grade, any species group.

b. Plywood for Countertops: Exterior type, A-C Grade.

2.1.5 Hardwood Plywood

HPVA HP-1, Type II (Interior) , Premium (A) Grade, hardwood veneer core construction, face veneers of thickness indicated.

2.1.6 Hardboard

DOC/NIST PS58, standard type, 1/8 inch thick.

2.2 COUNTER TOPS

2.2.1 Laminated Plastic

ANSI/NEMA LD 3.

2.2.1.1 Countertop Finish

Grade GP 50 or PF 42, satin finish. Color and pattern shall be as indicated.

2.2.1.2 Backing Sheet

BK 20.

2.2.2 Solid Surface

Manufactured from homogeneous solid sheets for filled plastic resin complying with materials and performance requirements of ANSI Z 124.3, for Type 5 or Type 6, without a precoated finish.

2.3 MOISTURE CONTENT OF WOOD PRODUCTS

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products at time of delivery to the job site, and when installed, shall be as follows:

a. Interior Finish Lumber, Trim, and Millwork 1-1/4 Inches Nominal or Less in Thickness: 6 percent on 85 percent of the pieces and 8 percent on remainder.

b. Moisture content of other materials shall be in accordance with the applicable standards.

2.4 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

2.4.1 Pressure Treatment

Lumber and plywood used on the exterior of buildings or in contact with masonry or concrete shall be treated with water-borne preservative listed in AWPA P5 as applicable, and inspected in accordance with AWPA M2. Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standards Committee. Plywood shall be treated to a reflection level as follows:

Exterior wood molding and millwork within 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.5 HARDWARE

Provide sizes, types, and spacings of manufactured building materials recommended by the product manufacturer except as otherwise indicated or specified.

2.5.1 Wood Screws

ASME B18.6.1.

2.5.2 Bolts, Nuts, Lag Screws, and Studs

ASME B18.2.1 and ASME B18.2.2.

2.5.3 Nails

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

2.5.4 Adjustable Shelf Standards

ANSI/BHMA A156.9, Type, surface mounted, with shelf rests Type, bracket.

2.6 FABRICATION

2.6.1 Quality Standards (QS)

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in AWI Qual Stds. Items not specified to be of a specific grade shall be Custom grade. The AWI QS is superseded by all contract document requirements indicated or stated herein.

2.6.2 Countertops

Fabricate with lumber and a core of exterior plywood, glued and screwed to form an integral unit. Bond laminated plastic under pressure to exposed surfaces, using type of glue recommended by plastic manufacturer, and bond a backing sheet under pressure to underside of countertop. Countertop unit shall be post-formed type with no-drip nose, cove moulding, and Style A back splash, and covered with ANSI/NEMA LD 3, Grade PF 42 plastic. Back splash shall be not less than 3-1/2 inches nor more than 4-1/2 inches high.

2.6.3 Cabinets

Wall and base cabinets shall be of the same construction and appearances. Fabricate with solid ends and frame fronts, or with frames all around.

Frames shall be solid hardwood not less than 3/4 by 1-1/2 inches. Ends, bottom, back, partitions, and doors shall be hardwood plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Cover exposed edges of plywood with hardwood strips. Doors, frames, and solid exposed ends shall be 3/4 inch thick; bottom, partitions, and framed ends 1/2 inch minimum; shelves 5/8 inch minimum; back 1/4 inch minimum.

2.6.3.1 Cabinet Hardware

ANSI/BHMA A156.9. Provide cabinet hardware including two self-closing hinges for each door, two side-mounted metal drawer slides for each drawer and pulls for all doors and drawers as follows. Hardware exposed to view shall be stainless steel. All cabinet hardware shall comply with the following requirements:

a. Provide concealed Euro-Style, back mounted hinges with opening to 165 degrees with self-closing feature at less than 90 degrees to its closed position.

b. Drawer slides shall have a static rating capacity of 100 lbs. The slides shall have a self-closing/stay-closed action, zinc or epoxy coated steel finish, ball bearing rollers, and positive stop with lift out design.

c. Drawer pulls shall be wire type pulls with center-to-center dimension not less than3-1/2 inches and cross sectional diameter of 5/16 inch. The handle projection shall be not less than 1-5/16 inches.

d. Drawer catch shall be heavy duty magnetic catch.

2.6.3.2 Finish

Provide a natural factory finish on wood surfaces after fabrication. Finish shall be fabricator's standard natural finish, except that it shall be equivalent to one coat of sealer and one coat of spar varnish on all surfaces and a second coat of spar varnish on surfaces exposed to view. Sand lightly and wipe clean between coats.

2.6.4 Workbenches

Fabricate as indicated. Dovetail and glue drawer corners. Fasten frames with suitable wood screws or bolts. Sand exposed surfaces smooth, and ease exposed edges. Provide two side-mounted, metal, ball-bearing drawer slides for each door.

2.6.5 Casework With Transparent Finish (CTF)

2.6.5.1 AWI Quality Grade (CTF)

Premium grade.

2.6.5.2 Construction (CTF)

Details shall conform to reveal overlay design.

2.6.5.3 Exposed Parts

Oak specie, rotary cut.

2.6.5.4 Semi-Exposed Parts

As specified in the AWI Qual Stds for the grade selected.

2.6.6 Casework With High Pressure Laminate Finish (CHPL)

2.6.6.1 AWI Quality Grade (CHPL)

Premium grade.

2.6.6.2 Construction (CHPL)

Details shall conform to reveal overlay design.

2.6.6.3 Exposed Surfaces

High pressure laminate, color and pattern as indicated.

2.6.6.4 Semi-Exposed Surfaces

As specified in the AWI Qual Stds for the grade selected.

PART 3 EXECUTION

3.1 FINISH WORK

Provide sizes, materials, and designs as indicated and as specified. Apply primer to finish work before installing. Where practicable, shop assemble and finish items of built-up millwork. Joints shall be tight and constructed in a manner to conceal shrinkage. Miter trim and moldings at exterior angles and cope at interior angles and at returns.Material shall show no warp after installation. Install millwork and trim in maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

3.1.1 Exterior Finish Work

Machine-sand exposed flat members and square edges. Machine-finish semi-exposed surfaces. Construct joints to exclude water. In addition to nailing, glue joints of built-up items with waterproof glue as necessary for weather-resistant construction. Provide well distributed end joints in built-up members. Provide shoulder joints in flat work. Hold backs of wide-faced miters together with metal rings and waterproof glue. Fascias and other flat members, unless otherwise indicated, shall be 3/4 inch thick. Provide door and window trim in single lengths. Provide braced, blocked, and rigidly anchored cornices for support and protection of vertical joints. Install soffits in largest practical size. Joints of plywood shall occur over center lines of supports. Fasten soffits with aluminum or stainless steel nails. Back prime all concealed surfaces of exterior trim.

3.1.2 Interior Finish Work

After installation, sand exposed surfaces smooth. Provide window and door trim in single lengths.

3.2 SHELVING

1 inch nominal thick wood shelf material or 3/4 or 23/32 inch thick plywood shelf material supported substantially with end and intermediate supports and arranged to prevent buckling and sagging. Provide cleats except where hook strips are specified or indicated. Where adjustable shelving is indicated, provide standards and brackets or shelf rests for each shelf. Anchor standards to wall at not more than 2 feet o.c.

3.3 MISCELLANEOUS

3.3.1 Counters

Construct as indicated. Conceal fastenings where practicable, fit counter neatly, install in a rigid and substantial manner, and scribe to adjoining surfaces. Provide counter sections in longest lengths practicable; keep joints in tops to a minimum; and where joints are necessary, provide tight hairline joints drawn up with concealed-type heavy pull-up bolts. Glue joints with water-resistant glue and, in addition, make rigid and substantial with screws, bolts, or other approved fastenings.

3.3.2 Cabinets

Install level, plumb, and tight against adjacent walls. Secure cabinets to walls with concealed toggle bolts, and secure top to cabinet with concealed screws. Make cut-outs for fixtures to templates supplied by fixture manufacturer. Carefully locate cut-outs for pipes so that edges of holes will be covered by escutcheons.

3.3.3 Workbenches

Construct as indicated. Install level, plumb, and tight against adjacent construction. Fasten to walls with screws or toggle bolts and to floors with expansion bolts.

3.3.4 Wood Bumpers

Bore, countersink, and bolt in place where indicated.

3.4 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints.Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners.Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

-- End of Section --

SECTION 06 41 16.00 10

LAMINATE CLAD ARCHITECTURAL CASEWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A161.2	(1998) Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(8th Edition) AWI Quality Standards

ASTM INTERNATIONAL (ASTM)

ASTM F 547	(2006) Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	(2010) Cabinet Hardware

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.2	(2009) Medium Density Fiberboard (MDF) for Interior Applications

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 1-A	(2007) Architectural Wood Flush Doors

1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework cabinets as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

SD-03 Product Data

Wood Materials;
Wood Finishes;
Finish Schedule;

SD-04 Samples

Plastic Laminates;
Cabinet Hardware;

SD-07 Certificates

Laminate Clad Casework

1.4 QUALITY ASSURANCE

1.4.1 General Requirements

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the premium grade quality standards as outlined in AWI Qual Stds, Section 400G and Section 400B for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of AWI Qual Stds requirements, in general, and the specific AWI Qual Stds requirements provided in this specification. The quality control statement shall also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

1.5 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

1.6 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Lumber

a. All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal 3/4 inch hardwood.

b. Standing or running trim casework components, which are specified to receive a transparent finish, shall be oak hardwood species, plain sawn. AWI grade shall be premium. Location, shape, and dimensions shall be as indicated on the drawings.

2.1.2 Panel Products

2.1.2.1 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in CPA A208.2.

2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section 06 61 16 SOLID POLYMER (SOLID SURFACING) FABRICATIONS.

2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of ANSI/NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on the drawings. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 5 by 7 inches in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 0.048 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

2.3.3 Horizontal General Purpose Postformable (HGP) Grade

Horizontal general purpose postformable grade plastic laminate shall be 0.042 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

2.3.4 Vertical General Purpose Postformable (VGP) Grade

Vertical general purpose postformable grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of components where postforming is required for curved surfaces.

2.3.5 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.020 inches in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

2.3.6 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.020 inches. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for casework cabinet interior and drawer interior surfaces.

2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be 0.020 inch thick. Material width shall be as indicated on the drawings. Color and pattern shall match exposed door and drawer front laminate pattern and color.

2.6 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include hinges, pulls, drawer glides. All hardware shall conform to ANSI/BHMA A156.9, unless otherwise noted, and shall consist of the following components:

a. Door Hinges: 5 knuckle wrap around type, 26D dull chrome finish, unless specified otherwise.

b. Cabinet Pulls: Wire pull type, satin stainless steel finish, unless specified otherwise.

c. Drawer Slide: Side mounted type, 26D dull chrome finish with full extension and a minimum 100 pound load capacity. Slides shall include an integral positive stop to avoid accidental drawer removal.

d. Adjustable Shelf Support System:

(1) Recessed (mortised) metal standards, BHMA No. BO4071, finish: 26D. Support clips for the standards shall be closed type, BHMA No. B04081, finish: satin.

2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F 547 where applicable.

2.8 ADHESIVES, CAULKS, AND SEALANTS

2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use polyvinyl acetate resin emulsion. Adhesives shall withstand a bond test as described in WDMA I.S. 1-A.

2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be adhesive consistent with AWI and laminate manufacturer's recommendations. PVC edgebanding shall be adhered using a polymer-based hot melt glue.

2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

2.9 WOOD FINISHES

Paint, stain, varnish and their applications required for laminate clad casework components shall be as indicated in Section 09 90 00 PAINTS AND COATINGS. Color and location shall be as indicated on the drawings.

2.10 ACCESSORIES

2.10.1 Grommets

Grommets shall be plastic material for cutouts with a diameter of 2 inches. Locations shall be as indicated on the drawings.

2.11 FABRICATION

Verify field measurements as indicated in the shop drawings before fabrication. Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI premium grade unless otherwise indicated in this specification. Cabinet style, in accordance with AWI Qual Stds, Section 400-G descriptions, shall be as indicated on the drawings.

2.11.1 Base and Wall Cabinet Case Body

2.11.1.1 Cabinet Components

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

a. Body Members (Ends, Divisions, Bottoms, and Tops): 3/4 inch veneer core plywood panel product.

b. Face Frames and Rails: 3/4 inch hardwood lumber.

c. Shelving: 3/4 inch medium density fiberboard (MDF) panel product.

d. Cabinet Backs: 1/4 inch veneer core plywood panel product.

e. Drawer Sides, Backs, and Subfronts: 1/2 inch panel product.

f. Drawer Bottoms: 1/4 inch veneer core plywood panel product.

g. Door and Drawer Fronts: 3/4-inch medium density fiberboard (MDF) panel product.

2.11.1.2 Joinery Method for Case Body Members

a. Tops, Exposed Ends, and Bottoms.

(1) Steel "European" assembly screws (1-1/2 inch from end, 5 inch on center, fasteners will not be visible on exposed parts).

(2) Doweled, glued under pressure (approx. 4 dowels per 12 inches of joint).

(3) Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).

b. Exposed End Corner and Face Frame Attachment.

(1) For mitered joint: lock miter or spline or biscuit, glued under pressure (no visible fasteners).

(2) For non-mitered joint (90 degree): butt joint glued under pressure (no visible fasteners).

c. Cabinet Backs (Wall Hung Cabinets): Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

(1) Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.

d. Cabinet Backs (Floor Standing Cabinets).

(1) Side bound, captured in grooves; glued and fastened to top and bottom.

e. Wall Anchor Strips shall be required for all cabinets with backs less than 1/2 inch thick. Strips shall consist of minimum 1/2 inch thick lumber, minimum 2-1/2 inches width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

2.11.2 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from 3/4 inch medium density fiberboard (MDF. All door and drawer front edges shall be surfaced with high pressure plastic laminate, color and pattern to match exterior face laminate as indicated on the drawings.

2.11.3 Drawer Assembly

2.11.3.1 Drawer Components

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

b. Drawer Sides and Backs For Laminate Finish: 1/2 inch thick 7-ply hardwood veneer core substrate.

c. Drawer Sides and Back For Thermoset Decorative Overlay (melamine) Finish: 1/2 inch thick medium density particleboard or MDF fiberboard substrate.

d. Drawer Bottom: 1/4 inch thick thermoset decorative overlay melamine panel product.

2.11.3.2 Drawer Assembly Joinery Method

a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.

b. Doweled, glued under pressure.

2.11.4 Shelving

2.11.4.1 General Requirements

Shelving shall be fabricated from 3/4 inch medium density fiberboard MDF. All shelving top and bottom surfaces shall be finished with HPDL plastic laminate or thermoset decorative overlay (melamine). Shelf edges shall be finished in a HPDL plastic laminate or thermoset decorative overlay (melamine).

2.11.4.2 Shelf Support System

The shelf support system shall be:

a. Recessed (mortised) metal shelf standards. Standards shall be mortised flush with the finishes surface of the cabinet interior side walls, two per side. Standards shall be positioned and spaced on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Standards shall be installed and adjusted vertically to provide a level, stable shelf surface when clips are in place.

2.11.5 Laminate Clad Countertops

Laminate countertop substrate shall be constructed of 3/4 inch medium density fiberboard (MDF). The substrate shall be moisture-resistant where countertops receive sinks, lavatories, or are subjected to liquids. All substrates shall have sink cutout edges sealed with appropriate sealant against moisture. No joints shall occur at any cutouts. A balanced backer sheet is required.

2.11.5.1 Edge Style

Front and exposed side countertop edges shall be in shapes and to dimensions as shown on the drawings. The countertop edge material shall be:

a. Post formed plastic laminate. Laminate edge shall be integral with countertop surface. Shape and profile shall be as indicated on the drawings and to dimensions as indicated on the drawings.

2.11.5.2 Laminate Clad Splashes

Countertop splash substrate shall be 3/4 inch MDF fiberboard. Laminate clad backsplash shall be loose, to be installed at the time of countertop installation. Side splashes shall be straight profile and provided loose, to be installed at the time of countertop installation. Back and side splash laminate pattern and color shall match the adjacent countertop laminate.

2.11.6 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and ANSI/NEMA LD 3, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

a. Base/Wall Cabinet Case Body.

(1) Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGP.

(2) Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: HPDL Grade CLS, Thermoset Decorative Overlay (melamine).

b. Adjustable Shelving.

(1) Top and bottom surfaces: HPDL Grade HGS.

(2) All edges: HPDL Grade VGS.

c. Fixed Shelving.

(1) Top and bottom surfaces: HPDL Grade HGS.

(2) Exposed edges: HPDL Grade VGS.

d. Door, Drawer Fronts, Access Panels.

(1) Exterior (exposed) and interior (semi-exposed) faces: HPDL Grade VGP

(2) Edges: HPDL Grade VGS.

e. Drawer Assembly.

All interior and exterior surfaces: HPDL Grade CLS, Thermoset Decorative Overlay (melamine).

f. Countertops and Splashes: All exposed and semi-exposed surfaces: HPDL Grade HGS

g. Tolerances: Flushness, flatness, and joint tolerances of laminated surfaces shall meet the AWI Qual Stds premium grade requirements.

2.11.7 Finishing

2.11.7.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

2.11.7.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

2.11.7.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings and Section 09 90 00 PAINTS AND COATINGS. All cabinet reveals shall be painted. Submit descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with AWI Qual Stds for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall comply with applicable requirements for AWI Qual Stds premium quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

3.1.1 Anchoring Systems

3.1.1.1 Floor

Base cabinets shall utilize a floor anchoring system. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abuts a wall surface, anchoring shall include a minimum 1/2 inch thick lumber or panel product hanging strip, minimum 2-1/2 inch width; securely attached to the top of the wall side of the cabinet back.

3.1.1.2 Wall

Cabinet to be wall mounted shall utilize minimum 1/2 inch thick lumber or panel product hanging strips, minimum 2-1/2 inch width; securely attached to the wall side of the cabinet back, both top and bottom.

3.1.2 Countertops

Countertops shall be installed in locations as indicated on the drawings. Countertops shall be fastened to supporting casework structure with mechanical fasteners, hidden from view. All joints formed by the countertop or countertop splash and adjacent wall surfaces shall be filled with a clear silicone caulk. Loose back and side splashes shall be adhered to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Joints between the countertop surface and splash shall be filled with clear silicone caulk in a smooth consistent concave bead. Bead size shall be the minimum necessary to fill the joint and any surrounding voids or cracks.

3.1.3 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 3/16 inch "Euroscrews". The use of wood screws without insertion dowels is prohibited.

3.1.4 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI Qual Stds premium grade requirements.

3.1.5 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.6 Glass

Install glass and glazing in the casework using methods and materials specified in Section 08 81 00 GLAZING in locations as indicated on the drawings.

-- End of Section --

SECTION 06 61 16

SOLID POLYMER (SOLID SURFACING) FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2583	(2007) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 570	(1998; R 2010e1) Standard Test Method for Water Absorption of Plastics
ASTM D 638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D 696	(2008) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 21	(2009) Determining Resistance of Synthetic Polymeric Materials to Fungi

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO Z124.3	(2005) Plastic Lavatories
IAPMO Z124.6	(2007) Plastic Sinks

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

NSF INTERNATIONAL (NSF)

NSF/ANSI 51	(2009e) Food Equipment Materials

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS Scientific Certification Systems (SCS)Indoor Advantage

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk (2010) Handbook for Ceramic Tile Installation

1.2 SYSTEM DESCRIPTION

a. Work under this section includes countertops, window stools, and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.

b. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.

c. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus 1/4 inch.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Solid polymer material
Fabrications

SD-04 Samples

Material;
Countertops;

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

1.6 WARRANTY

Provide manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

PART 2 PRODUCTS

2.1 MATERIAL

Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting IAPMO Z124.3 and IAPMO Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 1/4 inch in thickness. Submit a minimum 4 by 4 inch sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work.

2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4000 psi (min.)	ASTM D 638
Hardness	55-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303

1/4" sheet	36", 1/2 lb ball, no failure	
1/2" sheet	140", 1/2 lb ball, no failure	
3/4" sheet	200", 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.1% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	30 max	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.2 Acrylic-modified Polymer Solid Surfacing Material

Cast, solid polymer material shall be composed of a formulation containing acrylic and polyester polymers, mineral fillers, and pigments. Acrylic polymer content shall be not less than 5 percent and not more than 10 percent in order to meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4100 psi (min.)	ASTM D 638
Hardness	50-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4" sheet	36", 1/2 lb ball, no failure	
1/2" sheet	140", 1/2 lb	

	ball, no failure	
3/4" sheet	200", 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.6% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	100 max	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.3 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project color schedule. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.4 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting TCA Hdbk, Underwriter's Laboratories (UL) listed. Use this adhesive to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Use sealant to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 4 mils thick, applied around the edges of cut outs containing hot or cold appliances.

2.2.5 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

2.3.1 Joints and Seams

Form joints and seams between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Counter and Vanity Top Splashes

Fabricate backsplashes and end splashes from 3/4 inch thick solid surfacing material to be 4 inches high. Backsplashes and end splashes shall be provided for all counter tops. Backsplashes shall be shop fabricated and be permanently attached.

2.3.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition.

2.3.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Window Stools

Fabricate window stools from 3/4 inch thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings and selected from manufacturer's available pre-fabricated standards.

2.3.5 Countertops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 3/4 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high permanently attached, 90 degree transition. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

2.3.6 Solid Polymer Sinks

Solid polymer sinks shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer countertops. Sinks shall be of the same polymer composition as the adjoining counter top.Sink design shall support a seam adhesive undermount installation method. Sinks shall be a double bowl configuration. Sink dimensions shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.1.1 Loose Counter Top Splashes

Mount loose splashes in the locations noted on the drawings. Loose splashes shall be adhered to the counter top with a color matched silicone sealant when the solid polymer components are solid colors. Use a clear silicone sealant to provide adhesion of particulate patterned solid polymer splashes to counter tops.

3.1.2 Silicone Sealant

Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost.

-- End of Section --

SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4263	(1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4479	(2000) Asphalt Roof Coatings - Asbestos Free
ASTM D 449	(2003) Asphalt Used in Dampproofing and Waterproofing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction

1.2 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing manufacturer's original labels. Labels shall include date of manufacture, contents of each container, performance standards that apply to the contents and recommended shelf life.

1.3 SAFETY AND HEALTH REQUIREMENTS

If coal-tar pitch materials are used, the Contractor shall conform to all OSHA 29 CFR 1926 and General Industry Health Standards as well as state and local standards.

PART 2 PRODUCTS

2.1 ASPHALT

ASTM D 449, Type I or Type II.

2.2 ASPHALT PRIMER

ASTM D 41.

2.3 FIBROUS ASPHALT

ASTM D 4479, Type I for horizontal surfaces, Type II for vertical surfaces.

2.4 SURFACE PROTECTION

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with ASTM D 4263. If test indicates moisture, allow a minimum of 7 additional days after test completion for curing. If moisture still exists, redo test until substrate is dry.

3.2 APPLICATION

Prime surfaces to receive asphaltic dampproofing unless recommended otherwise by dampproofing materials manufacturer. Apply dampproofing after priming coat is dry, but prior to any deterioration of primed surface, and when ambient temperature is above 40 degrees F.

3.2.1 Surface Priming

Prime surfaces to receive fibrous asphalt dampproofing with asphalt primer. Apply primer when ambient temperature is above 40 degrees F and at rate of approximately one gallon per 100 square feet, fully covering entire surface to be dampproofed.

3.2.2 Cold-Application Method

Apply two coats of fibrous asphalt to surfaces to be dampproofed. Apply each coat uniformly using not less than one gallon fibrous asphalt per 50 square feet. Apply first coat by brush or spray to provide full bond with primed surface. Brush or spray second coat over thoroughly dry first coat unless recommended otherwise by dampproofing materials manufacturer. Provide finished surface that is of uniform thickness and impervious to moisture. Recoat porous areas.

-- End of Section --

SECTION 07 21 16 MINERAL

FIBER BLANKET INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2005) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 3833/D 3833M	(1996; R 2006) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM E 136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2009; TIA 10-3) National Fuel Gas Code
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket insulation;

Vapor retarder;

Pressure sensitive tape

Accessories

SD-08 Manufacturer's Instructions

Insulation

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Smoking

Do not smoke during installation of blanket thermal insulation.

1.5.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C665, Type I, blankets without membrane coverings ; Class A, membrane-faced surface with a flame spread of 25 or less, except a flame spread rating of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84.

2.1.1 Thermal Resistance Value (R-VALUE)

As indicated

2.1.2 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section. The minimum required recycled materials content by weight are:

Rock Wool: 75 percent slag
Fiberglass: 20 to 25 percent glass cullet

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

2.2 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E 136 for blocking around chimneys and heat producing devices.

2.3 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D 3833/D 3833M.

2.4 ACCESSORIES

2.4.1 Adhesive

As recommended by the insulation manufacturer.

2.4.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.4.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.

b. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

c. Gas Fired Appliances: Clearances as required in NFPA 54.

d. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E 136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

3.3.1.5 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

-- End of Section --

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1289	(2007) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 208	(1995; R 2001) Cellulosic Fiber Insulating Board
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2005) Approval Guide
FM P7825c	(2005) Approval Guide Building Materials
FM P9513	(2002) Specialist Data Book Set for Roofing Contractors; contains 1-22 (2001), 1-28 (2002), 1-29 (2002), 1-28R/1-29R (1998), 1-30 (2000), 1-31 (2000), 1-32 (2000), 1-33 (2000), 1-34 (2001), 1-49 (2000), 1-52 (2000), 1-54 (2001)

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2007) Building Materials Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wood nailers

Tapered roof insulation system;

Show location and spacing of wood nailers that are required for securing insulation and for backnailing of roofing felts. Show a complete description of the procedures for the installation of each phase of the system indicating the type of materials, thicknesses, identity codes, sequence of laying insulation, location of ridges and valleys, special methods for cutting and fitting of insulation, and special precautions. The drawings shall be based on field measurements.

SD-03 Product Data

Fasteners

Insulation;

Include minimum thickness of insulation for steel and concrete decks and fastener pattern for insulation on steel decks.

SD-06 Test Reports

Flame spread and smoke developed ratings

Submit in accordance with ASTM E 84.

SD-07 Certificates

Installer qualifications

SD-08 Manufacturer's Instructions

Nails and fasteners

Roof insulation, including field of roof and perimeter attachment requirements.

1.3 MANUFACTURER'S CERTIFICATE

Submit certificate from the insulation manufacturer attesting that the installer has the proper qualifications for installing tapered roof insulation systems.

Certificate attesting that the polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.4 QUALITY ASSURANCE

1.4.1 Insulation on Steel Decks

Roof insulation shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when

tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Bld Mat Dir as meeting the flame spread and smoke developed ratings will be accepted in lieu of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Bld Mat Dir or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials to site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

a. Name of manufacturer;

b. Brand designation;

c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification; and

d. Asphalt's flashpoint (FP), equiviscous temperature (EVT), and finished blowing temperature (FBT).

Deliver materials in sufficient quantity to allow continuity of the work.

1.5.2 Storage and Handling

Store and handle materials in a manner to protect from damage, exposure to open flame or other ignition sources, and from wetting, condensation or moisture absorption. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Store felt rolls on ends. For the 24 hours immediately before application of felts, store felts in an area maintained at a temperature no lower than 50 degrees F above grade and having ventilation around all sides. Replace damaged material with new material.

1.6 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

1.7 PROTECTION OF PROPERTY

1.7.1 Flame-Heated Equipment

Locate and use flame-heated equipment so as not to endanger the structure or other materials on the site or adjacent property. Do not place flame-heated equipment on the roof. Provide and maintain a fire extinguisher near each item of flame-heated equipment.

1.7.2 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings at least 6 inches, secure them against wind, and vent them to prevent collection of moisture on the covered surfaces. Keep protective coverings in place for the duration of the work with asphalt products.

1.7.3 Special Protection

Provide special protection approved by the insulation manufacturer, or avoid heavy traffic on completed work when ambient temperature is above 80 degrees F.

1.7.4 Drippage of Bitumen

Seal joints in and at edges of deck as necessary to prevent drippage of asphalt into building or down exterior walls.

PART 2 PRODUCTS

2.1 INSULATION

2.1.1 Insulation Types

Roof insulation shall be of the following materials and compatible with attachment methods for the specified insulation and roof membrane:

a. Polyisocyanurate Board: ASTM C 1289 Type II, Class 1 or 2, Grade 2 or 3 fibrous felt or glass mat membrane both sides, except minimum compressive strength shall be 20 pounds per square inch (psi).

ASTM C 208 Type II, Grade 1 or 2, roof insulating overlay/cover board, treated with sizing, wax or bituminous impregnation. Bituminous impregnation shall be limited to 4 percent by weight when used over steel decks. Maximum board size: 4 feet by 4 feet.

2.1.2 Recovered Materials

Provide thermal insulation materials containing recycled materials to the extent practical. The required minimum recycled material content for the listed materials are:

Polyisocyanurate: 9 percent recovered material

2.1.3 Insulation Thickness

As necessary to provide a thermal resistance (R value) of 30 or more at metal roof panels except for exterior canopies. Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

2.1.4 Tapered Roof Insulation

One layer of the tapered roof insulation assembly shall be factory tapered to a slope of not less than 1/4 inch per foot. Provide starter and filler blocks as required to provide the total thickness of insulation necessary to meet the specified slope and thermal conductance. Mitered joints shall be factory fabricated and shall consist of two diagonally cut boards or one board shaped to provide the required slopes. Identify each piece of tapered

insulation board by color or other identity coding system, allowing the identification of different sizes of tapered insulation board required to complete the roof insulation system.

2.1.5 Cants and Tapered Edge Strips

Provide preformed cants and tapered edge strips of the same material as the roof insulation; or, when roof insulation material is unavailable, provide pressure-preservative treated wood, wood fiberboard, or rigid perlite board cants and edge strips as recommended by the roofing manufacturer, unless otherwise indicated. Face of cant strips shall have incline of 45 degrees and vertical height of 4 inches. Taper edge strips at a rate of one to 1 1/2 inch per foot down to approximately 1/8 inch thick.

2.2 PROTECTION BOARD

For use as a thermal barrier (underlayment), fire barrier (overlayment), or protection board for hot-mopped, torched-down, or adhesively-applied roofing membrane over roof insulation.

2.2.1 Fiberboard

a. Wood Fiberboard: ASTM C 208, high density, except 4 by 4 feet maximum board size.

2.3 BITUMENS

2.3.1 Asphalt Primer

ASTM D 41.

2.3.2 Asphalt

ASTM D 312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and for mechanical spreader application shall be indicated on bills of lading or on individual containers.

2.3.3 Asphalt Roof Cement

ASTM D 4586, Type I for horizontal surfaces and for surfaces sloped from 0 to 3 inches per foot, Type II for vertical and surfaces sloped more than 3 inches per foot.

2.4 FASTENERS

Flush-driven through flat round or hexagonal steel or plastic plates. Steel plates shall be zinc-coated, flat round not less than 1 3/8 inch diameter or hexagonal not less than 28 gage. Plastic plates shall be high-density, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fastener head shall recess fully into the plastic plate after it is driven. Plates shall be formed to prevent dishing. Do not use bell-or cup-shaped plates.

2.4.1 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws conforming to FM AS 4470 and listed in FM P7825c for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of 90 psf conforming to FM P7825.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

3.1.1 Surface Inspection

Surfaces shall be clean, smooth, and dry. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The Contractor shall inspect and approve the surfaces immediately before starting installation. Prior to installing insulation, perform the following:

a. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.

3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage and hollow or low spots and perform the following:

a. Install wood nailers the same thickness as insulation at eaves, edges, curbs, walls, and roof openings for securing cant strips, gravel stops, gutters, and flashing flanges. On decks with slopes of one inch per foot or more, install wood nailers perpendicular to slope for securing insulation. Space nailers in accordance with approved shop drawings.

b. Cover steel decks with a layer of insulation board of sufficient thickness to span the width of a deck rib opening, and conforming to fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement conforming to FM P7825. Insulation joints parallel to ribs of deck shall occur on solid bearing surfaces only, not over open ribs.

3.2 INSULATION INSTALLATION

Apply insulation in multiple layers with staggered joints when total required thickness of insulation exceeds 2 inches. Lay insulation so that continuous longitudinal joints are perpendicular to direction of roofing, as specified in Section 07 52 00, "MODIFIED BITUMINOUS MEMBRANE ROOFING", and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, joints of each succeeding layer shall be parallel and offset in both directions with respect to layer below. Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface.

3.2.1 Special Precautions for Installation of Foam Insulation

3.2.1.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, mechanically fasten bottom 1 1/2 inch insulation layer max. board size = 4'x8". Provide bottom layer compliant with manufacturer's requirements for uplift indicated. Adhere upper layer(s), max. board size = 4'x4". Install 1/2 inch thick wood fiberboard over top surface of foam board insulation where modified bitumen roof membrane systems are to be installed. Stagger joints of insulation with respect to foam board insulation below.

3.2.2 Cant Strips

Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof. Wood cant strips shall bear on and be anchored to wood blocking. Fit cant strips flush against vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install in an adhesive approved by insulation manufacturer.

3.2.3 Tapered Edge Strips

Where indicated, provide edge strips in the right angle formed by junction of roof and wood nailing strips that extend above level of roof. Install edge strips flush against vertical surfaces of wood nailing strips. Where possible, nail edge strips to adjoining surfaces. Where installed against non-nailable materials, install in an adhesive approved by insulation manufacturer.

3.3 PROTECTION

3.3.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with the finished roofing specified in Modified Bituminous Membrane Roofing on same day. Do not permit phased construction. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight to conform to indicated live load limits of roof construction. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent.

3.3.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

3.4 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with FM P9513.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION 07 24 00

EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2009) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C1177/C1177M	(2008) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1186	(2008) Standard Specification for Flat Non-Asbestos Fiber Cement Sheets
ASTM C1278/C1278M	(2007a) Standard Specification for Fiber-Reinforced Gypsum Panel
ASTM C473	(2010) Physical Testing of Gypsum Panel Products
ASTM C578	(2011) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C67	(2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C847	(2010a) Standard Specification for Metal Lath
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 2247	(2011) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	(2000; R 2005) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D 968	(2005; R 2010) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 2098	(2000; R 2006) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and

	Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 695	(2003; R 2009) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 153	(2004; R 2010) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)

EIMA TM 101.01	(1995) Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS), Class PB
EIMA TM 101.86	(1995) Resistance of Exterior Insulation Finish Systems (EIFS), Class PB to The Effects of Rapid Deformation (Impact)

INTERNATIONAL CODE COUNCIL (ICC)

ICC UBC	(1997; Erratas Vol 1, 2 & 3 01/2001; Vol 1 & 2 03/2001; Vol 2 10/2001) Uniform Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268	(2007) Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of sheathing, insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components shall be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials shall be installed by an applicator approved by the system manufacturer. EIFS shall be Class PB as indicated and shall be color and finish as indicated.

1.2.1 System Requirements and Tests

The system shall meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E 331. There shall be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.4 psf, or 20 percent of positive design wind pressure, whichever is greater.

1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with ASTM E 330 (procedure A) to a minimum pressure of 45 psf. There shall be no permanent deformation, delamination, or other deterioration.

1.2.1.3 Full scale or intermediate scale fire test

Conduct wall fire test using apparatus, specimen, performance criteria, and procedure in accordance with ICC UBC, Chapter 26-4. The specimen shall include the complete system using 4 inch thick insulation board. At the option of the contractor, ICC UBC, Chapter 26-9, Intermediate-Scale Test may be substituted in lieu of the Full-Scale Multi- Story Fire test. The following requirements shall be met:

a. No vertical spread of flame within core of panel from one story to the next.

b. No flame spread over the exterior surface.

c. No vertical flame spread over the interior surface from one story to the next.

d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

1.2.2 Component Requirements and Tests

The components of the system shall meet the performance requirements as verified by the tests listed below.

1.2.2.1 Surface Burning Characteristics

Conduct ASTM E 84 test on samples consisting of base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index shall be 25 or less and the smoke developed index shall be 450 or less.

1.2.2.2 Radiant Heat

The system shall be tested in accordance with NFPA 268 on both the minimum and maximum thickness of insulation intended for use with no ignition during the 20-minute period.

1.2.2.3 Impact Resistance

a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with EIMA TM 101.86. The test specimen shall exhibit no broken reinforcing fabric per EIMA TM 101.86 at an impact of 150 in/lb.

b. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with ASTM E 695. The test specimen shall exhibit no cracking or denting after twelve impacts by 30 lbs lead shot mass from 6 in to 6 ft drop heights in 6 in intervals.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building. For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D 968, Method A. Test a minimum of two specimens. After testing, the specimens shall show only very slight smoothing, with no loss of film integrity after 132 gallons of sand.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G 153, Cycle 1. After 2000 hours specimens shall exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D 3273. The specimen shall consist of the finish coat material, applied to clean 3 inch by 4 inch glass slides and shall be allowed to cure for 28 days. After 28 days of exposure, the specimen shall not show any growth.

1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B117. The specimen shall be a minimum of 4 inch by 6 inch and shall be tested for a minimum of 300 hours. After exposure, the specimen shall exhibit no observable deterioration, such as chalking, fading, or rust staining.

1.2.3.5 Water Resistance

Test in accordance with ASTM D 2247. The specimen shall be a minimum of 4 inch by 6 inch. After 14 days, the specimen shall exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.6 Absorption-Freeze/Thaw

Class PB systems shall be tested in accordance with EIMA TM 101.01 for 60 cycles of freezing and thawing. No cracking, checking, or splitting, and

negligible weight gain. Class PM systems shall be tested in accordance with ASTM C67 for 50 cycles of freezing and thawing. After testing, the specimens shall exhibit no cracking or checking and have negligible weight gain.

1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component 12 by 24 inches, on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

1.2.4 Moisture Analysis

Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop drawings;

Show wall layout, construction and expansion joints, decorative grooves, layout of sheathing board, thermal insulation board, and reinforcing mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; details at windows and or doors; and details at base, roof and corners.

SD-03 Product Data

Sheathing board;

Thermal insulation;

Mechanical Fasteners;

Reinforcing fabric

Finish coat

Joint Sealant

Sealant Primer

Bond breaker

Backer Rod

Insulation Board

Warranty

Include joint and other details, such as end conditions, corners, windows, and parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include material safety data sheets (MSDS)for all components of the EIFS. The MSDS shall be available at the job site.

SD-04 Samples

Sample Boards;

Color and Texture

SD-05 Design Data

Wind load Calculations;

SD-06 Test Reports

Abrasion resistance

Accelerated weathering

Impact resistance

Mildew resistance Salt

spray resistance

Water vapor transmission

Absorption-freeze-thaw

Wall fire test

Water penetration

Water resistance

Surface Burning Characteristics

Radiant heat

Wind load

SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of EIFS Manufacturer

The EIFS shall be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

The EIFS Installer shall be trained by the EIFS manufacturer to perform the installation of the System and shall have successfully installed at least five projects at or near the size and complexity of this project. The contractor shall employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator shall be experienced and competent in the installation of high performance industrial and commercial sealants and shall have successfully installed at least five projects at or near the size and complexity of this project.

1.4.5 Insulation Board

Insulation Board shall be approved and labeled under third party quality program as required by applicable building code.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

1.6 ENVIRONMENTAL CONDITIONS

a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.

b. Apply sealants and wet materials only at ambient temperatures of 40 degrees F or above and rising, unless supplemental heat is provided. The system shall be protected from inclement weather and to maintain this temperature for a minimum of 24 hours after installation.

c. Do not leave insulation board exposed to sunlight after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty shall run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 SHEATHING BOARD

2.2.1 Fiber Reinforced Cement Sheathing Board

a. Meet ASTM C1186, Type A, Grade I.

b. Non-combustible per ASTM E 136.

c. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

d. Thickness no less than 1/2 inch.

e. Water Absorption not to exceed 17 percent.

2.2.2 Glass Mat Gypsum Sheathing Board

a. Conform to ASTM C1177/C1177M; or.

b. ASTM C1278/C1278M, Water Resistant Exterior Type only

c. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

2.3 ADHESIVE

Manufacturer's standard product, including primer as required, and shall be compatible with substrate and insulation board to which the system is applied.

2.4 LATHING AND FURRING

Conform to ASTM C847, 2.5 lb/sq yd, self-furring, galvanized.

2.5 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.6 THERMAL INSULATION

2.6.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

2.6.2 Insulation Board

Insulation board shall be standard product of manufacturer and shall be compatible with other systems components. Boards shall be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degree F, and thickness. No layer of insulation shall be less than 3/4 inch thick. The maximum thickness of all layers shall not exceed 4 inches Insulation Board shall be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

a. Thermal resistance: As indicated

b. Insulating material: ASTM C578 Type I as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.

c. Drainage: Preform channels into the interior face of insulation board or provide polypropylene drainage lath spacer to provide water drainage system.

2.7 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.8 REINFORCING FABRIC

Reinforcing fabric mesh shall be alkali-resistant, balanced, open weave , glass fiber fabric made from twisted multi-end strands specifically treated

for compatibility with the other system materials, and comply with ASTM E 2098 and as recommended by EIFS manufacturer.

2.9 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

2.10 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.11 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, expansion joints. All metal items and fasteners to be corrosion resistant.

2.12 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C920, as Type S or M, minimum Grade NS, minimum Class 25 and compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.13 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.14 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface shall be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate shall be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge.Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation

instructions but provide a flatness of not more that 1/4 inch in 10 feet. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor shall not proceed with the installation until all noted deficiencies of the substrate are corrected.

3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS shall be installed only by an applicator trained by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations.

3.3.1 Sheathing Board

Edges and ends of boards shall be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board to metal panels and girts with self-tapping drywall screws. Place fasteners sufficiently close to support imposed loads, but not more than:

a. Maximum of 8 inches apart on each supporting stud

Space fasteners more closely when required for negative wind load resistance.

3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least 8 inches. Align drainage channels of integral drainage system or provide polypropylene drainage lath space to provide a path for any water weeped from behind the insulation to escape wall construction. Use L-shaped insulation board pieces at corners of openings. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Gaps greater than 1/16 inch between the insulation boards shall be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than 1/16 inch shall be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board shall be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

3.3.2.1 Mechanically Fastened Insulation Boards

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 2 feet horizontally and vertically.

3.3.2.2 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer's instructions.

3.3.3 Base Coat and Reinforcing Fabric Mesh,

3.3.3.1 Class PB Systems

Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with manufacturer's instructions. Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh shall not be visible. Provide diagonal reinforcement at opening corners. Back-wrap or edge wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 2.5 inches on previously installed mesh, or butted, in accordance with the manufacturer's instructions.

3.3.4 Finish Coat

The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., shall be corrected prior to the application of the finish coat. Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved sample. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat shall be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied.

3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat or base coat with EIFS Manufacturer's color coating. Do not apply sealant to the finish coat.

3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 0.5 inch for perimeter seals and 0.75 inch for expansion joints. The width shall not be less than 4 times the anticipated movement. Check

sealant manufacturer's recommendations regarding proper width to depth ratio.

3.4.2 Sealant

Do not apply sealant until all EIFS coatings are fully dry. Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or can not be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor shall establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance shall be removed and replaced or corrected in an approved manner.

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

SECTION 07 41 13

METAL ROOF PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341	(2005; Supp 2001) Seismic Provisions for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002) Cold-Formed Steel Design Manual Set
AISI/COS/NASPEC	(2001, Supplement 2004) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7-05	(2006) Minimum Design Loads for Buildings and Other Structures, Including Supplement No. 1

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M	(2004; Errata 2004) Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2006; Errata 2006) Structural Welding Code - Steel
AWS D1.2/D1.2M	(2003; Errata 2004) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M	(2007a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel

ASTM A 653/A 653M	(2007) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 755/A 755M	(2003) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A 792/A 792M	(2006a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A 924/A 924M	(2007) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 792	(2004) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1308	(2002; R 2007) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1667	(2005) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 1970	(2001) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D 2244	(2007) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2447	(2003) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter

ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 3363	(2005) Film Hardness by Pencil Test
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	(2005) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Standard Test Method for Specular Gloss
ASTM D 5894	(2005) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(2007) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002e1) Evaluating Degree of Blistering of Paints
ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 968	(2005e1) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 2140	(2001) Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

FM GLOBAL (FM)

FM 4471	(1995) Class I Panel Roofs

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA RSDM	(2000) Metal Roofing Systems Design Manual

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0405	(2001; R 2003, 5th Ed) Roofing and Waterproofing Manual
NRCA ASMMRM	(2006) Architectural Sheet Metal and Metal Roofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2006) Architectural Sheet Metal Manual, Sixth Edition, Second Printing

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 12	(1982; E 2000) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-28578	(Rev B; CANC Notice 1) Paint, Water-Borne, Acrylic or Modified Acrylic, Semi-Gloss, for Metal Surfaces

UNDERWRITERS LABORATORIES (UL)

UL 580	(2006) Tests for Uplift Resistance of Roof Assemblies
UL Bld Mat Dir	(2007) Building Materials Directory

1.2 DESCRIPTION OF METAL ROOF SYSTEM

1.2.1 Performance Requirements

Steel panels and accessory components must conform to the following standards:

ASTM A 1008/A 1008M
ASTM A 123/A 123M
ASTM A 36/A 36M
ASTM A 755/A 755M for metallic coated steel sheet for exterior coil prepainted applications.
ASTM A 924/A 924M for metallic coated steel sheet
ASTM D 522 for applied coatings
UL Bld Mat Dir

1.2.1.1 Hydrostatic Head Resistance

No water penetration when tested according to ASTM E 2140. Submit leakage test report upon completion of installation.

1.2.1.2 Wind Uplift Resistance

Provide metal roof panel system that conform to the requirements of ASTM E 1592 and UL 580. Uplift force due to wind action governs the design for panels. Submit wind uplift test report prior to commencing installation.

Roof system and attachments must resist the wind loads as determined by ASCI/SEI 7-05, in pounds per square foot. Metal roof panels and component materials must also comply with the requirements in FM 4471 as part of a panel roofing system as listed in Factory Mutual Guide (FMG) "Approval Guide" for class 1 or noncombustible construction, as applicable. Identify all materials with FMG markings.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing Panels;

Flashing and Accessories;

Gutter/Downspout Assembly;

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Roof panels;

FACTORY-APPLIED COLOR FINISH;

Accessories;

Fasteners;

Pressure Sensitive Tape;

UNDERLAYMENTS; ice and water shield

Gaskets and Sealing/Insulating Compounds;

Enamel Repair Paint;

Galvanizing Repair Paint; G

SD-04 Samples

Roof Panels;

Factory-applied Color Finish, samples, 9 inch lengths, full width;

Accessories;

Fasteners;

Gaskets and Sealant/Insulating Compounds;

SD-05 Design Data

Wind Uplift Resistance;

SD-06 Test Reports

Leakage Test Report;

Wind Uplift Test Report;

Fire Rating Test Report;

Factory Finish and Color Performance Requirements;

SD-07 Certificates

Roof Panels;

Self-Adhering Polyethylene Film Ice and Water Shield Underlayment;

Qualification of Manufacturer;

Qualification of Applicator;

SD-08 Manufacturer's Instructions

INSULATION;

INSTALLATION MANUAL;

SD-09 Manufacturer's Field Reports

Manufacturer's Field Inspection Reports;

SD-11 Closeout Submittals

Warranties;

Information Card;

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

Submit documentation verifying metal roof panel manufacturer has been in the business of manufacturing metal roof panels for a period of not less than 5 years.

Manufacturer must also provide engineering services by an authorized engineer, currently licensed in the geographic area of the project, with a minimum of five (5) years experience as an engineer knowledgeable in roof wind design analysis, protocols and procedures for MBMA RSDM, ASCE/SEI 7-05, UL 580, and FM 4471. Engineer must provide certified engineering calculations for the project conforming to the stated references.

1.4.1.1 Manufacturer's Technical Representative

The manufacturer's technical representative must be thoroughly familiar with the products to be installed, installation requirements and practices, and with any special considerations in the geographical area of the project. The representative must perform field inspections and attend meetings as specified.

1.4.1.2 Single Source

Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer, and the most recent design of the manufacturer to operate as a complete system for the intended use.

1.4.2 Qualification of Applicator

Metal roof system applicator must be approved, authorized, or licensed in writing by the roof panel manufacturer and have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer, approved at a level capable of providing the specified warranty. Supply the names, locations and client contact information of 5 projects of similar size and scope constructed by applicator using the manufacturer's roofing products submitted for this project within the previous three years.

1.4.3 Field Verification

Prior to the preparation of drawings and fabrication, verify location of roof framing, roof openings and penetrations, and any other special conditions. Indicate all special conditions and measurements on final shop drawings.

1.4.4 Qualifications for Welding Work

Welding procedures must conform to AWS D1.1/D1.1Mfor steel or AWS D1.2/D1.2M for aluminum.

Operators are permitted to make only those types of weldments for which each is specifically qualified.

1.4.5 Pre-roofing Conference

After approval of submittals and before performing roofing system installation work, hold a pre-roofing conference to review the following:

a. Drawings, specifications, and submittals related to the roof work. Submit, as a minimum; sample profiles of roofing panels, with factory-applied color finish samples, flashing and accessories, gutter/downspout assembly samples, typical fasteners and pressure sensitive tape, sample gaskets and sealant/insulating compounds. Also include data and 1/2 pint sample of enamel repair paint and galvanizing repair paint, and technical data on factory formed panels, and manufacturer's installation manual.

b. Roof system components installation;

c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;

d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

e. Quality control plan for the roof system installation;

f. Safety requirements.

Coordinate pre-roofing conference scheduling with the Contracting Officer. Attendance is mandatory for the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of metal roof system, flashing and sheet metal work, mechanical and electrical work, other trades interfacing with the roof work, and representative of the metal roofing manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.5 DELIVERY, HANDLING, AND STORAGE

Deliver, store, and handle panel materials, bulk roofing products, accessories, and other manufactured items in a manner to prevent damage and deformation, as recommended by the manufacturer, and as specified.

1.5.1 Delivery

Package and deliver materials to the site in undamaged condition. Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use, except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, deformation, dampness, and staining.Remove affected materials from the site and immediately replace.. Remove moisture from wet materials not otherwise affected, restack and protect from further moisture exposure.

1.5.2 Handling

Handle materials in a manner to avoid damage. Select and operate material handling equipment so as not to damage materials or applied roofing.

1.5.3 Storage

Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering which prevents trapping of water or condensation under the covering. Store roof panels so that water which may have accumulated during transit or storage will drain off. Do not store panels in contact with materials that might cause staining. Secure coverings and stored items to protect from wind displacement.

1.6 PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit metal roof panel work to be performed

according to manufacturer's written instructions and warranty requirements, and specified safety requirements.

1.7 FABRICATION

Fabricate and finish metal roof panels and accessories on a factory stationary industrial type rolling mill to the greatest extent possible, per manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements. Comply with indicated profiles, dimensional and structural requirements.

Provide panel profile, as indicated on drawings including major ribs for full length of panel. Fabricate panel side laps with factory installed captive gaskets or separator strips providing a weather tight seal and preventing metal-to metal contact, and minimizing noise from movements within the panel assembly.

1.7.1 Finishes

Finish quality and application processes must conform to the related standards specified within this section. Noticeable variations within the same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize any contrasting variations.

1.7.2 Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 as applicable to the design, dimensions, metal, and other characteristics of the item indicated.

a. Form exposed sheet metal accessories which are free from excessive oil canning, buckling, and tool marks, and are true to line and levels indicated, with exposed edges folded back to form hems.

b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

c. Sealed Joints: Form non-expansion, but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA 1793.

d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

e. Fabricate cleats and attachments devices of size and metal thickness recommended by SMACNA or by metal roof panel manufacturer for application, but not less than the thickness of the metal being secured.

1.8 WARRANTIES

Provide metal roof system material, weather tightness and workmanship warranties meeting specified requirements. Provide revision or amendment to manufacturer's standard warranty as required to comply with the specified requirements.

1.8.1 Metal Roof Panel Manufacturer Warranty

Furnish the metal roof panel manufacturer's 20-year roof system materials and installation workmanship warranty, including flashing, insulation, components, trim, and accessories necessary for a watertight roof system construction. Make warranty directly to the Government, commencing at time of Government's acceptance of the roof work. The warranty must state that:

a. If within the warranty period, the metal roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-weathertight, shows evidence of moisture intrusion within the assembly, displaces, corrodes, perforates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the metal roof system and correction of defective workmanship is the responsibility of the metal roof panel manufacturer. All costs associated with the repair or replacement work are the responsibility of the metal roof panel manufacturer.

b. If the manufacturer or his approved applicator fail to perform the repairs within 48 hours of notification, emergency temporary repairs performed by others does not void the warranty.

1.8.2 Weathertightness Warranty

Metal roof system manufacturer shall submit, for Government review and acceptance, a specimen copy of the manufacturer's Weathertightness Warranty, including evidence of application for warranty and manufacturer's acceptance of the applicator and warranty conditions. Warranty shall be a Single-Source Warranty. The specified warranty requirements and conditions are required to be satisfied, regardless of the manufacturer's standard warranty language or preferences. Roofing payments will be subject to additional withholdings at the Government's discretion pending provision of acceptable executed roofing manufacturer's and Contractor's roofing warranties.

Single Source Warranty: Single Source Warranties require a certified installer on site at all times:

a. For a period of twenty (20) years from the date of substantial completion, the roofing manufacturer WARRANTS to the Building Owner (Owners): to furnish roof panels, flashing and related items used to fasten the roof panels, and flashing including roof jack and curb attachments to the roof structure, will not allow intrusion of water from the exterior of the roofing manufacturer's Roof System into the building envelope when exposed to wind and weather conditions, excluding tornado or hurricane conditions, and ordinary wear and usage. The date of substantial completion is the date that is certified by the Owner's Representative, when the roofing manufacturer's Roofing System is complete and accepted by the Owner. Roofing will not be accepted, nor will any warranty commence, so long as the original roofing installation is not made watertight.

2. Manufacturer's Field Service

a. During installation, provide a minimum of two on-site inspections of roof application by qualified technical representative of the manufacturer.

b. Upon completion of installation, provide final written inspection report by a technical representative of roofing manufacturer to confirm that roofing system has been installed in accordance with manufacturer's requirements.

3. The roofing manufacturer shall have the SOLE AND EXCLUSIVE obligation for all warranty work commencing on the date of roofing substantial completion and under all circumstances terminates on the twenty (20) year anniversary of the date certified as Substantial Completion of the roofing manufacturer's Roof System. During the period in which the roofing manufacturer has any warranty obligation, the roofing manufacturer shall take appropriate actions necessary to cause the non-performing portions of the Roof System to perform their proper functions.

4. Roofing Manufacturer's Liability:

The total liability of the roofing manufacturer under Single Source warranty is a no dollar limit of the manufacturers Roof System as invoiced to the roofing manufacturer's customer.

1.8.3 Manufacturer's Finish Warranty

Provide a manufacturer's 20 year warranty for the roofing system. Issue the warranty directly to the Government at the date of Government acceptance warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244. Installation of the roofing in a coastal environment shall not diminish or void the finish warranty.

1.8.4 Metal Roof System Installer Warranty

Provide roof system installer warranty for a period of not less than two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof panel installation, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Issue warranty directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials is the responsibility of the metal roof system installer. All costs associated with the repair or replacement work are the responsibility of the installer.

1.9 CONFORMANCE AND COMPATIBILITY

The entire metal roofing and flashing system must be in accordance with specified and indicated requirements, including wind resistance and seismic per AISC 341 requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the MBMA RSDM, NRCA 0405, the metal panel manufacturer's published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or

indicated requirements to the Contracting Officer for approval prior to installation.

1.10 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of English unit measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The English units for the measurements shown are as follows:

	PRODUCTS	ENGLISH UNITS
a.	Panels - vertical legs	16/18 inches 2 inches
b.	Screws	No. 14 No. 12
c.	Bolts	1/4 inch
d.	Studs	3/16 inch
e.	Fasteners	1/2 inch One inch
f.	Rivets	1/16 inch 1/8 inch

PART 2 PRODUCTS

2.1 ROOF PANELS

2.1.1 Steel Sheet Panels

Roll-form steel sheet roof panels to the specified profile, with fy = 22 gauge and depth as indicated.
Material must be plumb and true, and within the tolerances listed:

a. Aluminum-Zinc alloy coated steel sheet conforming to ASTM A 792/A 792M and AISI SG03-3.

b. Individual panels to have continuous length sufficient to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not a part of the panel profile and free from damage to the finish coating system.

c. Provide panels with thermal expansion and contraction consistent with the type of system specified, and the following profile.

d. Profile to be a 2 inch high standing seam, 16 or 18 inch coverage with mechanical crimping or snap-together seams with concealed clips and fasteners.

2.2 FACTORY FINISH AND COLOR PERFORMANCE REQUIREMENTS

All panels are to receive a factory applied polyvinylidene fluoride finish consisting of a baked topcoat with a manufacturer's recommended prime coat conforming to the following:

a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with an acid rinse, and thorough drying.

b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 + 0.05 mils. The prime coat must be oven cured prior to application of the finish coat.

c. Exterior Finish Coating: Apply the exterior finish coating over the primer by roll coating to a dry film thickness of 0.80 + 0.05 mils for a total dry film thickness of 1.00 +0.10 mils. This exterior finish coat must be oven-cured.

d. Interior finish coating: Apply a wash coat on the reverse side over primer by roll coating to a dry film thickness of 0.30 + 0.05 mils for a total dry fill thickness of 0.50 +0.10 mils. The wash coat must be oven cured.

e. Color: The exterior finish chosen from the manufacturer's standard color chart.

f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General: SSPC Paint 12, MIL-P-28578, ASTM D 5894, and ASTM D 4587.

Abrasion: ASTM D 968
Adhesion: ASTM D 3359
Chalking: ASTM D 4214
Chemical Pollution: ASTM D 1308
Color Change and Conformity: ASTM D 2244
Creepage: ASTM D 1654
Cyclic Corrosion Test: ASTM D 5894
Flame Spread: ASTM E 84
Flexibility: ASTM D 522
Formability: ASTM D 522
Gloss at 60and 85 degrees: ASTM D 523
Humidity: ASTM D 2247 and ASTM D 714
Oxidation: ASTM D 610
Pencil Hardness: ASTM D 3363
Reverse Impact: ASTM D 2794
Salt Spray: ASTM B 117
Weatherometer: ASTM G 23 and ASTM D 822
ASTM B 117 withstand 2000 hours including scribe requirement. Upon completion of ASTM B 117 test, coating/finish receive rating of 10, no blistering by ASTM D 714 and rating of 7, ASTM D 1654, No. 1.

ASTM G 23/D 2565: accelerated weathering for 2000 hours. No cracking or loss of adhesion.
ASTM D 522: 180 degree bend over 1/8" mandrel; no loss of adhesion or micro-checking.
ASTM D 4214: 2000 hours, no more than No. 8 chalking.
ASTM D 2447: 1000 hours, no signs of blistering, cracking or corrosion
ASTM D 523: 30 plus or minus 5 at 60 degree angle.

2.2.1 Metal Panel System Manufacturer

Provide metal panel system by one of the following manufacturers:

Centria
105 Beaver Grade Road
Moon Township, PA 15108-2944
800-586-1372

McElroy Metals, Inc.
Architectural Products Division
555 Dividend Road
Peachtree City, GA 30269
800-950-6533

2.3 MISCELLANEOUS METAL FRAMING

2.3.1 General

Provide cold formed metallic-coated steel sheet conforming to ASTM A 653/A 653M, AISI/COS/NASPEC, and as specified in 05 40 00 COLD-FORMED METAL FRAMING unless otherwise indicated.

2.3.2 Fasteners and Miscellaneous Metal Framing

Provide compatible type, corrosion resistant, of sufficient size and length to penetrate the supporting element a minimum of one inch with other required properties to fasten miscellaneous metal framing members to substrates in accordance with the roof panel manufacturer's and ASCE/SEI 7-05 requirements.

2.3.2.1 Exposed Fasteners

Fasteners for roof panels must be corrosion resistant coated steel, compatible with the sheet panel or flashing material and of the type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories must be the manufacturer's standard. Provide an integral metal washer, matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick for exposed fasteners.

2.3.2.2 Screws

Provide corrosion resistant screws, coated steel of the type and size recommended by the manufacturer to meet the performance requirements.

2.3.2.3 Attachment Clips

Provide hot-dip galvanized, conforming to ASTM A 653/A 653M, clips. Size, shape, thickness and capacity must meet the thickness and design load criteria specified.

2.3.3 Electrodes for Manual, Shielded Metal Arc Welding

Electrodes for manual, shielded metal arc welding must meet the requirements of AWS D1.1/D1.1M, and be covered, mild-steel electrodes conforming to AWS A5.1/A5.1M.

2.4 ACCESSORIES

Accessories must be compatible with the metal roof panels. Sheet metal flashing, trim, metal closure strips, caps, and similar metal accessories must be not less than the minimum thicknesses specified for roof panels. Provide exposed metal accessories to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips must be closed-cell or solid-cell synthetic rubber or neoprene premolded to match configuration of the panels and not absorb or retain water.

2.4.1 Pre-manufactured Accessories

Pre-manufactured accessories must be manufacturer's standard for intended purpose, comply with applicable specification section, compatible with the metal roof system and approved for use by the metal roof panel manufacturer. Construct curbs to match roof slope.

2.4.2 Metal Closure Strips (Primary Closure)

Provide factory fabricated steel closure strips of the same gauge, color, finish and profile as the specified roof panel.

2.4.3 Rubber Closure Strips (Secondary Closure)

Provide closed-cell, expanded cellular rubber closure strips conforming to ASTM D 1056 and ASTM D 1667, extruded or molded to the configuration of the specified roof panel profile and in lengths supplied by roof panel manufacturer.

2.5 JOINT SEALANTS

2.5.1 Sealants

Sealants are to be an approved gun type for use in hand or air pressure caulking guns at temperatures above 40 degrees F (or frost-free application at temperatures above 10 degrees F) with a minimum solid content of 85 percent of the total volume. Sealant must dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather tight joint. No migratory staining, in conformance with to ASTM C 792, is permitted on painted or unpainted metal, stone, glass, vinyl or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the roof panel manufacturer.

2.5.1.1 Shop Applied Sealants

Sealant for shop-applied caulking must be an approved gun grade, non-sag one-component polysulfide or silicone conforming to ASTM C 792 and ASTM C 920, Type II, with a curing time which ensures the sealants plasticity at the time of field erection. Color to match panel color.

2.5.1.2 Field Applied Sealants

Sealants for field-applied caulking must be an approved gun grade, non-sag on-component polysulfide or two component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to ASTM C 920, Type II. Color to match panel color.

2.5.1.3 Tape Sealants

Provide pressure sensitive, 100 percent solid tape sealant with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof panel manufacturer.

2.5.2 Sheet Metal Flashing and Trim

2.5.2.1 Fabrication, General

Custom fabricate sheet metal flashing and trim to comply with recommendations within the SMACNA 1793 that apply to design, dimensions, metal type, and other characteristics of design indicated. Shop fabricate items to the greatest extent possible. Obtain and verify field measurements for accurate fit prior to shop fabrication. Fabricate flashing and trim without excessive oil canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

2.6 INSULATION

Insulation, facer material and attachment must be compatible with metal roof system specified, as approved by the roof panel manufacturer.

2.6.1 Fire Rated Roof Panel Assembly

Provide materials for fire-rated roof panel construction as follows:

Impaling clips, accessories, and fasteners must be UL listed 40 U18.24 UL Bld Mat Dir galvanized steel sheet or impaling bolts welded to each wall unit joint and spaced not more than 48 inches on center.

Provide bar subgirts 1-1/2- by 1/8 inch galvanized steel with slotted holes for welding to end of impaling clip spikes.

Provide galvanized steel structural angles and flashing angles, gage or thickness as indicated, or material as specified. Flashing angles must be not less than No. 18 U.S. standard gage.

Provide hot-dip galvanized steel metal facing conforming to ASTM A 653/A 653M, Grade A. Coating must conform to, ASTM A 653/A 653M and ASTM A 924/A 924M.

Metal facing must be as indicated and fabricated of enamel-coated hot-dip galvanized steel conforming to ASTM A 653/A 653M, Grade A. Coating must conform to ASTM A 653/A 653M and ASTM A 924/A 924M. Provide Class A fire

hazard classification finish. Flame spread, fuel contributed, or smoke developed cannot exceed a value of 25.

Submit fire rating test report to contracting officer for review and approval. Secure written approval prior to commencement of installation.

2.7 UNDERLAYMENTS

2.7.1 Self-Adhering Polyethylene Film Ice and Water Shield Underlayment

Provide self-adhering polyethylene film membrane ice and water shield underlayment material in compliance with ASTM D 1970, suitable for use as underlayment for metal roofing. Provide 30 mil membrane with tensile strength of 250 PSI, elongation factor of 250%, adhesion to plywood of 3 lb/in width. Permeance (max) of 0.05 perms max and installed material weight of 0.22 lb/sf.

2.8 GASKETS AND SEALING/INSULATING COMPOUNDS

Gaskets and sealing/insulating compounds must be nonabsorptive and suitable for insulating contact points of incompatible materials. Sealing/insulating compounds must be non-running after drying.

2.9 FINISH REPAIR MATERIAL

Repair paint for color finish enameled roofing must be compatible paint of the same formula and color as the specified finish furnished by the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work. Ensure surfaces are suitable, dry and free of defects and projections which might affect the installation.

Examine primary and secondary roof framing to verify that rafters, purlins, angels, channels, and other structural support members for panels and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer, UL, ASTM, and ASCE/SEI-7-05 requirements.

Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking; and that installation is within flatness tolerances required by metal roof panel manufacturer.

Examine rough-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of panels prior to installation.

Submit a written report to the Contracting Officer, endorsed by the installer, listing conditions detrimental to the performance of the work. Proceed with installation only after defects have been corrected.

3.2 INSTALLATION

Installation must meet specified requirements and be in accordance with the manufacturer's installation instructions and approved shop drawings. Do not install damaged materials. Dissimilar materials which are not compatible when contacting each other must be insulated by means of gaskets or sealing/insulating compounds. Keep all exposed surfaces and edges clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Remove stained, discolored, or damaged materials from the site.

3.2.1 Preparation

Clean all substrate substances which may be harmful to insulation, and roof panels including removing projections capable of interfering with insulation, and roof panel attachment.

Install sub-purlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

3.2.2 Underlayment

Install underlayment according to roof panel manufacturer's written recommendations and recommendation in NRCA "The NRCA Roofing and Waterproofing Manual".

3.2.2.1 Self-Adhering Sheet Underlayment

Install self-adhering sheet underlayment; wrinkle free on roof deck. Comply with low-temperature installation restrictions of manufacturer where applicable. Install full coverage over roof deck, lapped in a shingle fashion to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days. Repair any damage or unadhered edges prior to finished roof installation.

3.3 INSULATION INSTALLATION

Install insulation concurrently with metal roof panel installation, in thickness indicated on drawings, to cover entire roof, according to manufacturer's written instructions.

3.4 PROTECTION OF APPLIED MATERIALS

Do not permit storing, walking, wheeling, and trucking directly on applied roofing/insulation materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing/insulation materials, and to distribute weight to conform to indicated live load limits of roof construction.

3.5 FASTENER INSTALLATION

Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions.

3.5.1 Welding

Procedures for manual, shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work must be in accordance with AWS D1.1/D1.1M.

3.6 FLASHING, TRIM, AND CLOSURE INSTALLATION

3.6.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently water tight and weather resistant. Work is to be accomplished to form weather tight construction without waves, warps, buckles, fastening stresses or distortion, and to allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accomplish the work must conform to the manufacturers written instructions.

3.6.2 Metal Flashing

Install exposed metal flashing at building corners, rakes, eaves, junctions between metal siding and roofing, valleys and changes off slope or direction in metal roofing, building expansion joints and gutters.

Exposed metal flashing must be the same material, color, and finish as the specified metal roofing panels. Furnish flashing in minimum 8 foot lengths. Exposed flashing must have 1 inch locked and blind soldered end joints, with expansion joints at intervals of no greater than 16 feet.

Fasten flashing at not more than 8 inches on center for roofs, except where flashing is held in place by the same screws used to secure panels. Exposed flashing and flashing subject to rain penetration must be bedded in specified joint sealant. Flashing which is contact with dissimilar metals must be isolated by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge. Provide sheet metal closures at flashing terminations.

3.7 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels or other components of the Work securely in place, with provisions for thermal and structural movement in accordance with NRCA ASMMRM.

Steel Roof Panels: Use stainless steel fasteners for exterior surfaces and galvanized fasteners for unexposed surfaces.

Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions. Provide all blocking and nailers as required.

Metal Protection: Where dissimilar metals contact each other or possibly corrosive substrates, protect against galvanic action by permanent separation as recommended by the metal roof panel manufacturer.

Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and required for weatherproof performance of metal roof panel system. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

3.7.1 Handling and Erection

Erect roofing system in accordance with the approved erection drawings, printed instructions and safety precautions of the manufacturer.

Do not subject panels to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective panels. Damaged panels must be replaced and removed from the site at the contractor's expense. Erect panels true, plumb, and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with indicated rake, eave, and curb overhang. Allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Do not permit storage, walking, wheeling or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of the roof construction.

Roof panels must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than 8 inches; side laps of standard exterior corrugated panels must not be less than 2-1/2 corrugations.

Field cutting of metal roof panels by torch is not permitted. Field cut only as recommended by manufacturer's written instructions.

3.7.2 Closure Strips

Install metal double closure strips at open ends of metal ridge rolls; open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof, unless open ends are concealed with formed eave flashing; rake of metal roof unless open end has a formed flashing member; and in other required areas.

Install closure strips at intersection of the wall with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.7.3 Workmanship

Make lines, arises, and angles sharp and true. Free exposed surfaces from any visible wave, warp, buckle and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and as necessary to make the work watertight.

3.8 ACCEPTANCE PROVISIONS

3.8.1 Erection Tolerances

Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Horizontal lines must not vary more than 1/8 inch in 40 feet.

3.8.2 Leakage Tests

Finished application of metal roofing is to be subject to inspection and test for leakage by the Contracting Officer or his designated representative, and Architect/Engineer. Inspection and tests will be conducted without cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and removal/replacement of defective materials.

3.8.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials and as recommended by the metal roof panel manufacturer. Finished repaired surfaces must be uniform and free from variations of color and surface texture. Repaired metal surfaces that are not acceptable to the project requirements are to be immediately removed and replaced with new material.

3.8.4 Paint Finished Metal Roofing

Paint finished metal roofing will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period. Panels that indicate color changes, fading, or surface degradation, determined by visual examination, must be removed and replaced with new panels at no expense to the Government. New panels will be subject to the specified tests for an additional year from the date of their installation.

3.9 CLEAN UP AND DISPOSAL

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating. Touch up scratches in panel finish with manufacturer supplied touch-up paint system to match panel finish.

Collect all scrap/waste materials and place in containers. Promptly dispose of demolished and scrap materials. Do not allow scrap/waste materials to

accumulate on-site; transport immediately from the government property and legally dispose of them.

3.10 FIELD QUALITY CONTROL

3.10.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three times during the installation for purposes of reviewing materials installation practices and adequacy of work in place. Make inspections during the first 20 squares of roof panel installation, at mid-point of the installation, and at substantial completion, at a minimum. After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

Submit two signed copies of the manufacturer's field inspection reports to the Contracting Officer within one week of substantial completion.

3.11 INFORMATION CARD

For each type of roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm (0.032) inch thick aluminum card for exterior display. Format as directed in paragraph titled "Form One".

Make card 8 1/2 by 11 inches minimum. Information card must identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, roof panel manufacturer and product name, type underlayment(s), date of completion; installing contractor identification and contact information; manufacturer warranty expiration, warranty reference number, and contact information. Install card at location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

3.11.1 Form One

FORM 1 - PREFORMED STEEL PANEL ROOFING SYSTEM AND COMPONENTS

1. Contract Number:

2. Building Number & Location:

3. NAVFAC Specification Number:

4. Deck/Substrate Type:

5. Slopes of Deck/Roof Structure:

6. Insulation Type & Thickness:

7. Insulation Manufacturer:

8. Vapor Retarder: ( )Yes ( )No

9. Vapor Retarder Type:

10. Preformed Steel Standing Seam Roofing Description:

a. Manufacturer (Name, Address, & Phone No.):
b. Product Name: c. Width: d. Gage:
e. Base Metal: f. Method of Attachment:

11. Repair of Color Coating:

a. Coating Manufacturer (Name, Address & Phone No.):
b. Product Name:
c. Surface Preparation:
d. Recoating Formula:
e. Application Method:

12. Statement of Compliance or Exception:_____
_____
_____

13. Date Roof Completed:

14. Warranty Period: From_____ To_____

15. Roofing Contractor (Name & Address):

16. Prime Contractor (Name & Address):

Contractor's Signature_____ Date:

Roofing Manufacturer Inspector's Signature _____ Date:
Text

-- End of Section --

SECTION 07 42 13

METAL WALL PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501.1	(2005) Methods of Test for Exterior Walls

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002) Cold-Formed Steel Design Manual Set
AISI/COS/NASPEC	(2001, Supplement 2004) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7-05	(2006) Minimum Design Loads for Buildings and Other Structures, Including Supplement No. 1

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M	(2007a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel
ASTM A 606	(2004) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 653/A 653M	(2007) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 755/A 755M	(2003) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1308	(2002; R 2007) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1667	(2005) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 2244	(2007) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 3363	(2005) Film Hardness by Pencil Test
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	(2005) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Standard Test Method for Specular Gloss
ASTM D 5894	(2005) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

ASTM D 610	(2007) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002e1) Evaluating Degree of Blistering of Paints
ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 968	(2005e1) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM	(2002) Metal Building Systems Manual

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2006) Architectural Sheet Metal Manual, Sixth Edition, Second Printing

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 12	(1982; E 2000) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-28578	(Rev B; CANC Notice 1) Paint, Water-Borne, Acrylic or Modified Acrylic, Semi-Gloss, for Metal Surfaces

UNDERWRITERS LABORATORIES (UL)

UL 580	(2006) Tests for Uplift Resistance of Roof Assemblies
UL Bld Mat Dir	(2007) Building Materials Directory

1.2 DEFINITIONS

Metal Wall Panel: Metal wall panels, attachment system components and accessories necessary for a complete weather-tight wall system.

1.3 DESCRIPTION OF WALL PANEL SYSTEM

Factory color finished, metal wall panel system with concealed fastening attachment. Panel profiles must be as shown on drawings.

1.3.1 Metal Wall Panel General Performance

Comply with performance requirements, conforming to AISI/COS/NASPEC, without failure due to defective manufacture, fabrication, installation, or other defects in construction. Wall panels and accessory components must conform to the following standards:

ASTM A 1008/A 1008M
ASTM A 123/A 123M
ASTM A 36/A 36M
ASTM A 653/A 653M
ASTM A 606
ASTM D 522 for applied coatings
UL Bld Mat Dir

1.3.2 Structural Performance

Maximum calculated fiber stress must not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads is limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal siding. Contractor must provide design for members and connections not shown on the drawings. Siding panels and accessories must be the products of the same manufacturer.

Provide metal wall panel assemblies complying with the load and stress requirements in accordance with ASTM E 1592. Wind Load force due to wind action governs the design for panels.

Wall systems and attachments are to resist the wind loads as determined by UL 580 and ASCE/SEI 7-05 in the geographic area where the construction will take place, in pounds per square foot. Submit five copies of wind load tests and seismic tests to the Contracting Officer.

1.3.3 Air Infiltration

Air leakage must conform to the limits through the wall assembly area when tested according to ASTM E 283.

1.3.4 Water Penetration Under Static Pressure

No water penetration when tested according to ASTM E 331.

1.3.5 Water Penetration Under Dynamic Pressure

No evidence of water leakage when tested according to AAMA 501.1.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submit Documentation for the following items:

Qualification of Manufacturer;
Qualification of Installer;
Sample Warranty;

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Submit Manufacturer's catalog data for the following items:

Factory Color Finish
Closure Materials
Pressure Sensitive Tape
Sealants and Caulking
Accessories

SD-04 Samples

Submit as required each of the following samples:

Wall Panels, 12 inches long by actual panel width;
Fasteners;
Metal Closure Strips, 10 inches long of each type;

Submit manufacturer's color charts and chips, approximately 4 by 4 inches, showing full range of colors, textures and patterns available for wall panels with factory applied finishes.

SD-05 Design Data

As applicable, submit the following wind load design analysis; data, to include, but not limited to:

wind speed
exposure category,co-efficient,importance factor
type of facility
negative pressures for each zone
methods and requirements of attachment

SD-06 Test Reports

Submit test reports for the following in accordance with the referenced articles in this section.

Leakage Tests;
Wind Load Tests;
Coatings and Base Metal Tests;
Chalking Tests;

SD-07 Certificates

Submit certificates for the following items showing conformance with referenced standards contained in this section:

Fasteners;

SD-08 Manufacturer's Instructions

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications.

Installation of Wall panels;

SD-09 Manufacturer's Field Reports

Submit 2 copies of the Manufacturer's Field Reports;

SD-11 Closeout Submittals

Warranty;
Maintenance Instructions;

1.5 QUALITY ASSURANCE

1.5.1 Pre-Installation Conference

Upon notification of submittal receipt and approval by the Contracting Officer; and prior to the commencement of the work, the Contractor must attend a pre-installation conference to review the following:

a. Drawings and Specifications.

b. Qualification of Installer.

d. Sample Warranty

e. Sample wall panels, 12 inches long by actual panel width

f. Sample metal closure strips, 10 inches long of each type

g. Color charts and chips

h. Coatings and base metal tests, chalking tests

i. Construction schedule, availability of materials, Installer's personnel, equipment and facilities required to progress with the work without delay.

j. Methods and procedures related to installation of wall panels, including manufacturer's written instructions. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

k. Support conditions for compliance with requirements, including alignment between and attachment to structural members.

l. Flashing, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.

m. Governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

n. Temporary protection requirements for metal wall panel assembly during and after installation.

o. Wall panel observation and repair procedures after metal wall panel installation. Provide detailed written instructions including copies of Material Safety Data Sheets for maintenance and repair materials, and manufacturer's maintenance instructions.

1.5.1.1 Installation Drawings

Installation shop drawings for wall panels, flashing, accessories, and anchorage systems must indicate completely dimensioned structural frame and erection layouts, openings in the wall, special framing details, and construction details at corners, building intersections and flashing, location and type of mastic and metal filler strips.

1.5.1.2 Wind Load Design Analysis

Wind design analysis must include wall plan delineating dimensions and attachment patterns for each zone. Wind design analysis must be prepared and sealed by Licensed Project Engineer in the geographic area where the construction will take place.

1.5.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and installations in the geographical area where construction will take place.

1.5.3 Qualification of Manufacturer

Certify that metal wall panel system manufacturer has a minimum of five (5) years experience in manufacturing metal wall system and accessory products.

Manufacturer must also provide engineering services by an authorized engineer; currently licensed in the geographical area where construction will take place, having a minimum of four (4) years experience as an engineer knowledgeable in wind load design analysis, protocols and

procedures per MBMA MBSM, "Metal Building Systems Manual"; ASCE/SEI 7-05, and ASTM E 1592.

Provide certified engineering calculations, using the products submitted, for Wind load requirements in accordance with ASCE/SEI 7-05.

1.5.3.1 Manufacturer's Certificates

Also provide the following certifications from the manufacturer:

Coil Stock
Fasteners

Submit certification from coil stock manufacturer or supplier that the machinery used will form the provided coil stock without warping, waviness, or rippling that is not a part of the panel profile, and without damage, abrasion or marring of the finish coating.

Provide evidence that products used within this specification are manufactured in the United States.

1.5.4 Certified Qualification of Installation Contractor

The installation contractor must be approved and certified by the metal wall panel manufacturer prior to beginning the installation of the metal wall panel system. Subcontracting by Certified Contractor for the metal wall panel work is not permitted.

1.5.5 Single Source

Obtain each type of metal wall panels, clips, closure materials and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

1.6 DELIVERY, HANDLING, AND STORAGE

Deliver and protect package components, sheets, metal wall panels, and other manufactured items to prevent damage or deformation during transportation and handling.

Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack and store metal wall panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

Retain strippable protective covering on metal wall panel until actual installation.

1.7 PROJECT CONDITIONS

1.7.1 Field Measurements

Verify locations of wall framing and opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1.7.2 Weather Limitations

Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into wall system or building.

1.8 WARRANTY

Warranty must conform to the Sample Warranty as reviewed and approved by the Contracting Officer at the Pre-Installation Conference.

PART 2 PRODUCTS

2.1 METAL PANELS

2.1.1 Concealed Fastener Panels

Panels for walls, soffits and fascias shall be steel and shall have a factory-applied color finish. Wall panels shall have interlocking ribs for securing adjacent sheets. Panels shall be fastened to framework using concealed fasteners. Length of panels shall be sufficient to cover the entire height of any unbroken wall surface except where reveals are indicated. Panels shall be formed without warping, waviness, or ripples that are not a part of the panel profile and shall be free of damage to the finish coating system.

All exterior flashing and trim shall be fabricated in the same material, gage, finish and color as the exterior profile.

Zinc-coated steel conforming to ASTM A 653/A 653M, Structural Grade 40 and minimum G90 galvanized smooth metallic coating. Prepainted steel sheet shall also comply with ASTM A 755/A 755M. Wall and soffit panel material shall be minimum 22 ga. thick prior to coating application, and as required to meet wind load requirements. Panels shall be within 95 percent of the nominal thickness. Wall and soffit panels shall be smooth, 1 1/2" in depth and provide 12" of coverage width with tight joints between panels. Exterior surface shall have a 12 inch flush plane with a single stiffening bead located in the center of the 12 inch width. Prior to shipment, panels shall be treated with a passivating chemical and oiled to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.1.2 Exposed Fastener Panels

Panels for walls shall be steel and shall have a factory-applied color finish. Provide panel profiles indicated. Panels shall be fastened to framework using exposed fasteners. Length of panels shall be sufficient to cover the entire height of any unbroken wall surface except where reveals are indicated. Panels shall be formed without warping, waviness, or ripples that are not a part of the panel profile and shall be free of damage to the finish coating system.

All exterior trim shall be fabricated in the same material, gage, finish and color as the exterior profile.

Zinc-coated steel conforming to ASTM A 653/A 653M, Structural Grade 37 and minimum G90 galvanized smooth metallic coating. Prepainted steel sheet shall also comply with ASTM A 755/A 755M. Wall panel material shall be minimum 22 ga. thick prior to coating application, and as required to meet wind load requirements. Panels shall be within 95 percent of the nominal thickness. Wall panels shall be smooth and provided in two profiles:

a. Deep Ribbed Metal Panels shall have 36 inch of coverage width and 1 1/2 inch deep symmetrical ribs spaced at 7.2 inches with angular transitions, and with factory mitered edges where corners will be formed by adjacent panels.

b. Corrugated Metal Panels shall have 36 inch minimum coverage width and 1/2 inch deep symmetrical corrugations spaced at 2.67 inches.

Prior to shipment, panels shall be treated with a passivating chemical and oiled to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.1.3 Factory Insulated Wall Panels

Insulated wall panels shall be factory-fabricated flat panel units with integral reveals and insulating core between metal face sheets, securely fastened together and uniformly separated with rigid spacers; facing of embossed 22 gage steel, and liner panel of embossed 22 gage steel with primer and acrylic finish. Provide horizontal panels with joint configuration indicated. Panels shall be 2 inches thick and R14 or greater. Panels shall have a factory-applied color finish. The assembly shall have a flame spread rating not higher than 75, and smoke developed rating not higher than 450 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and not become a source of food and shelter for insects. Provide factory formed corners with lengths as indicated. Provide extrusions fabricated of 6063-T5 aluminum with exposed surfaces painted to match wall panels.

2.2 FABRICATION

Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. Fabricate metal wall panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

2.2.1 Sheet Metal Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 that apply to the design, dimensions, metal, and other characteristics of item indicated:

a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

b. End Seams: fabricate nonmoving end seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

c. Sealed Joints: form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA 1793.

d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA 1793 or by metal wall panel manufacturer for application, but not less than thickness of metal being secured.

2.3 PANEL MATERIALS

2.3.1 Steel Sheet

Roll-form steel wall panels to the specified profile, with gauge and depth as indicated. Material must be plumb and true, and within the tolerances listed:

a. Galvanized Steel Sheet conforming to ASTM A 653/A 653M and AISI SG03-3.

b. Individual panels must be continuous length to cover the entire length of any unbroken wall area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.

c. Provide panels with thermal expansion and contraction consistent with the type of system specified.

i. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated wall area.

ii. Embossed Surface Texture.

2.3.2 Factory Color Finish

Comply with NAAMM AMP 500 for recommendations for applying and designating finishes. Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

All panels are to receive a factory-applied Kynar 500/Hylar 5000 finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

2.3.2.1 Metal Preparation

Carefully prepare all metal surface for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.

2.3.2.2 Prime Coating

Apply a base coat of epoxy paint, specifically formulated to interact with the top-coat, to the prepared surfaces by roll coating to a dry film thickness of 0.20 mils. Prime coat must be oven cured prior to application of finish coat.

2.3.2.3 Exterior Finish Coating

Roll coat the finish coating over the primer by roll coating to dry film thickness of 0.80 for a total dry film thickness of 1.00. Oven-cure finish coat.

2.3.2.4 Interior Finish Coating

Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.20 + a backer coat of 0.30 for a total dry film thickness of 0.50. Oven-cured the wash coat.

2.3.2.5 Color

Provide exterior finish color as as specified.

2.3.2.6 Physical Properties

Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General: SSPC Paint 12, MIL-P-28578, ASTM D 5894, and ASTM D 4587.
Abrasion: ASTM D 968
Adhesion: ASTM D 3359
Chalking: ASTM D 4214
Chemical Pollution: ASTM D 1308
Color Change and Conformity: ASTM D 2244
Creepage: ASTM D 1654
Cyclic Corrosion Test: ASTM D 5894
Flame Spread: ASTM E 84
Flexibility: ASTM D 522
Formability: ASTM D 522
Gloss at 60 and 85 degrees: ASTM D 523
Humidity: ASTM D 2247 and ASTM D 714
Oxidation: ASTM D 610
Pencil Hardness: ASTM D 3363
Reverse Impact: ASTM D 2794
Salt Spray: ASTM B 117
Weatherometer: ASTM G 23 and ASTM D 822

2.4 MISCELLANEOUS METAL FRAMING

Cold-formed metallic-coated steel sheet conforming to ASTM A 653/A 653M and specified in Section 05 40 00 COLD-FORMED METAL FRAMING unless other wise indicated.

2.4.1 Fasteners for Miscellaneous Metal Framing

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to supporting members and substrates in accordance with the wall panel manufacturer's and ASCE/SEI 7-05 requirements.

2.5 FASTENERS

2.5.1 General

2.5.1.1 Hidden Fasteners

Provide corrosion resistant fasteners recommended by the manufacturer to meet the performance requirements and design loads.

2.5.1.2 Screws

Screws to be corrosion resistant coated steel, and/or 300 - series or 305 - series stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

2.5.1.3 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

2.5.1.4 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A 653/A 653M, Z275 G 90 or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

2.6 ACCESSORIES

2.6.1 General

All accessories must be compatible with the metal wall panels. Sheet metal flashing, trim, metal closure strips, caps and similar metal accessories must not be less than the minimum thickness specified for the wall panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips must be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

2.6.2 Rubber Closure Strips

Provide closed-cell, expanded cellular rubber conforming to ASTM D 1056 and ASTM D 1667; extruded or molded to the configuration of the specified wall panel and in lengths supplied by the wall panel manufacturer.

2.6.3 Metal Closure Strips

Provide factory fabricated steel closure strips to be the same gauge, color, finish and profile of the specified wall panel.

2.6.4 Joint Sealants

2.6.4.1 Sealants and Caulking

Provide approved gun type sealants for use in hand- or air-pressure calking guns at temperatures above 40 degrees F 4 degrees C (or frost-free application at temperatures above 10 degrees F minus 12 degrees C) with minimum solid content of 85 percent of the total volume. Sealants must dry with a tough, durable surface skin which permit remaining soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints receiving sealants with a compatible one-component or two-component primer as recommended by the wall panel manufacturer.

2.6.4.2 Shop-Applied

Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to ASTM C 920, Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

2.6.4.3 Field-Applied

Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to ASTM C 920, Type II. Color to match panel colors.

2.6.4.4 Pressure Sensitive Tape

Provide pressure sensitive tape sealant, 100% solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the wall panel manufacturer.

2.7 SHEET METAL FLASHING AND TRIM

2.7.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in SMACNA 1793 that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

2.8 REPAIR OF FINISH PROTECTION

Repair paint for color finish enameled wall panel must be compatible paint of the same formula and color as the specified finish furnished by the wall

panel manufacturer. Provide 2 quarts of repair paint matching the specified wall panels.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.

Examine primary and secondary wall framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer, UL, ASTM, ASCE/SEI 7-05 and as required for the geographical area where construction will take place.

Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

Submit to the Contracting Officer a written report, endorsed by Installer, listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment. Miscellaneous framing installation, including sub-purlins, girts, angles, furring, and other miscellaneous wall panel support members and anchorage must be according to metal wall panel manufacturer's written instructions.

3.3 WALL PANEL INSTALLATION

Provide full length metal wall panels, from sill to eave as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement in accordance with MBMA MBSM.

Erect wall panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Bent, chipped, or defective sheets shall not be applied.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated eave, and sill.

Work is to allow for thermal movement of the wall panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal wall panels by torch is not permitted.

3.3.1 Steel Wall Panels

Use stainless-steel fasteners for exterior surfaces and galvanized steel fasteners for interior surfaces.

3.3.2 Anchor Clips

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.3.3 Metal Protection

Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.3.4 Joint Sealers

Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

3.4 FASTENER INSTALLATION

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.5 FLASHING, TRIM AND CLOSURE INSTALLATION

3.5.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams to form permanently watertight and weather resistant.

Install sheet metal work is to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

3.5.2 Metal Flashing

Install exposed metal flashing at building corners, sills and eaves, junctions between metal siding and walling. Exposed metal flashing must be the same material, color, and finish as the specified metal wall panel.

Fasten flashing at a minimum of 8 inches on center, except where flashing is held in place by the same screws that secure covering sheets.

Flashing is to be furnished in at least 8 foot lengths. Exposed flashing is to have 1 inch locked and blind-soldered end joints, and expansion joints at intervals of not more than 16 feet.

Exposed flashing and flashing subject to rain penetration to be bedded in the specified joint sealant.

Isolate flashing which is in contact with dissimilar metals by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge.

3.5.3 Closures

Install metal closure strips at open ends of corrugated or ribbed pattern walls, and at intersection of wall and wall unless open ends are concealed with formed eave flashing; and in other required areas.

Install mastic closure strips at intersection of the wall with metal walling; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.6 WORKMANSHIP

Make lines, arises, and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side.Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

3.7 ACCEPTANCE PROVISIONS

3.7.1 Erection Tolerances

Erect metal wall panels straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions.

3.7.2 Leakage Tests

Finished application of metal wall panels are to be subject to inspection and test for leakage by request of the Contracting Officer, Architect/Engineer. Conduct inspection and tests at no cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and the removal and replacement of defective materials.

3.7.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials. Finished repaired surfaces must be uniform and free from variations of color and surface texture.

Repaired metal surfaces that are not acceptable to the project requirements and/or Contracting Officer are to be immediately removed and replaced with new material.

3.7.4 Paint-Finish Metal Siding

Paint-finish metal siding will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period.

Panels that indicate color changes, fading, or surface degradation, determined by visual examination, must be removed and replaced with new panels at no expense to the Government.

New panels will be subject to the specified tests for an additional year from the date of their installation.

3.8 FIELD QUALITY CONTROL

3.8.1 Construction Monitoring

Make visual inspections as necessary to ensure compliance with specified requirements. Additionally, verify the following:

a. Materials comply with the specified requirements.

b. All materials are properly stored, handled and protected from damage. Damaged materials are removed from the site.

c. Framing and substrates are in acceptable condition, in compliance with specification, prior to application of wall panels.

d. Panels are installed without buckles, ripples, or waves and in uniform alignment and modulus.

e. Side laps are formed, sealed, fastened or seam locked as required.

f. The proper number, type, and spacing of attachment clips and fasteners are installed.

g. Installer adheres to specified and detailed application parameters.

h. Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Provide five bound copies of Manufacturer's Field Reports to the Contracting Officer two weeks prior to project close-out.

3.9 CLEAN-UP AND DISPOSAL

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area continuously as work progresses. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, rust stains, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

Collect and place scrap/waste materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site; transport demolished materials from government property and legally dispose of them.

-- End of Section --

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2170	(2001a) Kinematic Viscosity of Asphalts (Bitumens)
ASTM D 228	1990a (Reapproved 1996) Standard Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles
ASTM D 312	(2000) Asphalt Used in Roofing
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4402	(2002) Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free
ASTM D 5147	(1997) Standard Test Method for Sampling and Testing Modified Bituminous Sheet Material
ASTM D 5849	(1995) Standard Test Method for Evaluating Resistance of Modified, Bituminous Roofing Membranes to Cyclic Joint Displacement
ASTM D 6162	(2000a) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D 6163	(2000e1) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

ASTM D 6164	(2000) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM E 108	(2000) Fire Tests of Roof Coverings

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2003) Approval Guide

UNDERWRITERS LABORATORIES (UL)

UL 790	(2004) Test Methods for Fire Tests of Roof Coverings
UL RMSD	(2004) Roofing Materials and Systems Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00, "Submittal Procedures."

SD-03 Product Data

Modified Bitumen Sheet;

Felts;

Primer;

Asphalt roof cement;

Fasteners;

Roof and Deck Insulation; G

Sample warranty certificate

Asphalt;

SD-07 Certificates

Qualification of manufacturer;

Qualification of applicator;

Warranty Application;

SD-08 Manufacturer's Instructions

Modified bitumen sheet;

Felts;

Primer;

Asphalt roof cement;

Fasteners;

Flashings;

Asphalt;

Cold weather installation

SD-11 Closeout Submittals

Information card;

1.3 QUALITY ASSURANCE

1.3.1 Product Data Requirements

Submit data for the roof insulation and modified Bitumen sheet as required below:

1.3.1.1 Roof Insulation Product Data Requirements

Submit all data required by Section 07220, "Roof and Deck Insulation," together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation provided.

1.3.1.2 Modified Bitumen Sheet Product Data Requirements

Manufactures published catalog data shall include the following information for each sheet type specified. This information shall be presented in the same units of measure stated in this specification and its referenced standards. The test method for determining the following sheet requirements are found in ASTM D 5147, ASTM D 228 for Net Mass (Weight) requirements, and in ASTM D 5849 for cyclic joint displacement.

a. Dimensions and Weight

(1) Thickness
(2) Net Mass (Weight)

b. Physical and Mechanical Properties

(1) Sheet type
(2) Load strain properties
(3) Ultimate elongation (fiberglass reinforcing only)
(4) Tear strength
(5) Low temperature flexibility
(6) Dimensional stability
(7) Compound stability
(8) Granule embedment

c. Performance

(1) Cyclic joint displacement

1.3.2 Manufacturer's Instruction Requirements

Include detailed application instructions and standard drawings altered as required by these specifications for modified bitumen sheet, primer, fasteners, asphalt roof cement, flashings, asphalt, and cold weather installation. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

1.3.3 CERTIFICATE REQUIREMENTS

1.3.3.1 Manufacturers Qualifications Certificates

Certify that the manufacturer of the modified bitumen membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer." Show evidence that products used within this specification are manufactured in the United States. Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

1.3.3.2 Warranty Application Certificate

Provide copy of Application for Roofing Guarantee from roofing contractor and Letter of Intent to Warrant for the roofing system by the Manufacturer.

1.3.4 Closeout Submittal Requirements

Furnish requirements as specified in paragraph entitled "Information Card" in PART 3 of this section.

1.3.5 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer shall have a minimum of 5 years experience in manufacturing modified bitumen roofing products specified herein.

1.3.6 Qualification of Applicator

Roofing system applicator shall be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and shall have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator shall supply the names and locations of 5 projects of similar size and scope that he has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.3.7 Fire Safety

Complete roof covering assembly shall:

a. Have ASTM E 108 Class 1A or UL 790, Class A classification; and

b. Be listed as part of Fire-Classified roof deck construction in UL RMSD, or Class I roof deck construction in FM P7825.

UL approved components of the roof covering assembly shall bear the UL label.

1.3.8 Wind Uplift

Complete roof covering assembly including the roof insulation shall be tested and rated in compliance with FM P7825 and shall be installed to meet an FM 1A-90 classification for the field of the roof with respective increased fastener attachment at the perimeters and corners of the roof.

1.3.9 Preroofing Conference

After approval of submittals and before performing roofing and insulation work, including associated work, the Contractor will hold a preroofing conference to review the following:

a. Drawings and specifications;

b. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, roof insulation, and installation of the roofing in accordance with the roof system warranty, the name of the manufacturer's technical representatives, the frequency of the onsite visits, copies of the roof status reports from the technical representatives to roof manufacturer, and pertinent structural details relating to the roofing system;

c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

d. Safety requirements.

Preroofing conference shall be attended by the designer, the Government, the Contractor and personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, mechanical and electrical work and representative of the roofing materials manufacturer. Before beginning roofing work, confirm in writing the resolution of conflicts among those attending the preroofing conference.

1.3.10 Field Samples and Tests

The Government reserves the right to sample roofing materials at random from the products delivered to the job site and test them to verify the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification or the approved substitution.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Ship modified bitumen sheet rolls stacked vertically on pallets wrapped with shrink wrap or shrink bags. Pallets to be surfaced with a continuous smooth surface to avoid damage to ends of rolls. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container shall bear the specification number, type, and class, as applicable. Labels or bill of lading for roofing asphalt shall indicate asphalt type, FP, FBT, and EVT, that is, the temperature at which the viscosity is either 125 centistokes when tested in accordance with ASTM D 2170 or 75 centipoise when tested in accordance with ASTM D 4402. Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.4.2 Storage

Protect materials against moisture absorption. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, and mortar is finished and dry. Maintain roll materials at temperatures above 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof and yet provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

1.4.3 Handling

Select and operate material handling equipment so as not to damage applied roofing. Prevent damage to edges and ends of roll materials.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Provide manufacturer's printed directions for installation during cold weather conditions.

1.6 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that flashing and counter flashing are installed as the work progresses. No phasing of the roof membrane system installation will be permitted. Same day installation of mechanically fastened bottom insulation board, adhered upper insulation board(s), base ply, base ply cap flashing, top ply and top ply cap flashing is required.

1.7 WARRANTY

Furnish the modified bitumen sheet roofing system manufacturer's "no-dollar-limit" warranty for the roofing system, including insulation, flashing, and

accessories. The warranty shall run directly to the Government. In no event shall the warranty period be less than 10 years from the date of the Government's acceptance of the work, notwithstanding roofing applicator's or manufacturer's unpaid invoices for installation, supplies, or service. The warranty shall state that:

a. When within the warranty period the roofing system becomes nonwatertight, splits, tears, blisters, or separates at the seams or shows any other evidence of excessive weathering, because of defective materials or workmanship, the repair or replacement of defective materials and correction of defective workmanship shall be the responsibility of the manufacturer;

b. When the manufacturer or the manufacturer's approved applicator fail to perform repairs within 72 hours of notification, emergency repairs performed by others will not void the warranty.

PART 2 PRODUCTS

2.1 DESCRIPTION OF ROOFING SYSTEM

2.1.1 Description of Roofing System

Provide roofing system as described below and capable of passing ASTM D 5849. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles at 14° F -10° C or 200 cycles after heat conditioning. Heat conditioning shall be in accordance to ASTM D 5147.

2.1.2 SBS Modified Bitumen Sheet on Non-Nailable Substrate

Substrate: Metal Deck

Components:	Quantity:
Asphalt Primer	3/4 gal/100 sq. ft.
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Base Sheet (MB)	1 ply
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

2.2 MATERIALS

2.2.1 Asphalt

ASTM D 312, Type IV.

2.2.2 Modified Bitumen Sheet, Felts

Provide all field sheets of the roofing membrane with the same type reinforcing material.

Designation	Use	Felt-Type	Impregnant	Coating	Specification

MB	SBS Modified Base Sheet	Fiber-glass or Poly-ester or combined fiberglass polyester	SBS Modified Bitumen	SBS Modified Bitumen	ASTM D 6162, Grade S, and as modified in subparagraph "a" below ASTM D 6163, Grade S, Type II and as modified in subpara. "b" below ASTM D 6164, Grade S, and as modified in subpara. "c" below
RSS	SBS Bitumen Cap Sheet Roofing Fire rated	Fiber-glass or Poly-ester	SBS Modified Bitumen	SBS Bitumen Granules	ASTM D 6162, Grade G,Type II and as modified in subpara. "a" below ASTM D 6163, Grade G, and as modified in subpara. "b" below ASTM D 6164, Grade G, and as modified in subpara. "c" below
FS	Flashing Sheet Fire rated	Fiber glass or fiberglass or combined	SBS Modified Bitumen	Granule Surfacing	ASTM D 6162, Grade S, and as modified in subparagraph "a" below ASTM D 6163, Grade S, Type II and as modified in subpara. "b" below ASTM D 6164, Grade S, and as modified in subpara. "c" below

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a. ASTM D 6162 Modifications (Combined Polyester and Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements

Property	Type II Grade: G and S
Low Temperature Flexibility, Max Before and After Heat Conditioning °F ° (C)	-5(-20)

(2) "7. Dimensions, Mass, and Permissible Values" Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirement.

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using A Combination of Polyester and Glass Fiber Reinforcements

Description	Type II
Thickness, min, mils (mm)	
Grade S	85 (2.2)
Grade G	150 (3.8)
Grade G (Selvage Edge)	95 (2.4)
Net mass unit area, min lbs/100 ft 2, (g/m2)	
Grade S	58 (2831)
Grade G	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

b. ASTM D 6163 Modifications (Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Property	Type II Grade: G and S
Elongation (ultimate) at 5% of maximum load 73.4 +/- 3.6 degrees F (23 +/- 2 degrees C), MD and XMD, min. (%)	
as manufactured:	40
after heat conditioning:	20
Compound stability at 225 degrees F (107 degrees C)	no failures

(2) "7. Dimensions, Mass and Permissible Variations." Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirement.

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Description	Type II
Thickness, min, mils (mm),	
Grade S	85 (2.2)
Grade G	150 (3.8)
Grade G (Selvage Edge)	95 (2.4)
Net mass/unit area, min, lbs/ft 2 (g/m 2)	
Grade S	58 (2831)
Grade G	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

2.2.3 Top Surfacing

Protect modified bitumen roofing system from direct exposure to the weather with the following surfacing.

2.2.3.1 Mineral Roofing Granules

Factory applied, Type II minimum granule embeddment, requiring no further coating.

2.2.4 Primer

ASTM D 41.

2.2.5 Asphalt Roof Cement

ASTM D 4586, Type II for vertical surfaces, Type I for horizontal surfaces.

2.2.6 Fasteners

Provide noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM AS 4470. For felts, provide fasteners driven through metal discs, or one piece composite fasteners with heads not less than one inch in diameter or one inch square with rounded or 45 degree tapered corners.

2.2.6.1 Concrete Walls and Vertical Surfaces

Provide hardened steel nails with flat heads, diamond shaped points, and mechanically deformed shanks not less than one inch long for securing felts, modified bitumen sheets, and metal Items to concrete walls and vertical surfaces. Use power-driven fasteners only when approved in writing.

2.2.7 Metal Discs (Tin Caps)

Flat noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM AS 4470; not less than 3 inches in diameter, when using screw type fasteners. Discs shall be formed to prevent dishing or cupping.

2.2.8 Roof Insulation Below Modified Bitumen Membrane System

Insulation shall be compatible with the membrane as recommended in modified bitumen manufacturer's printed instructions and as specified in Section 07 22 00, "Roof and Deck Insulation".

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Ensure that the following conditions exist prior to application of the roofing materials:

a. Drains, curbs, cants, perimeter walls, roof penetrating components, and equipment supports are in place.

b. Surfaces are rigid, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.

c. The plane of the substrate does not vary more than 1/4 inch within an area 10 by 10 feet when checked with a 10 foot straight edge placed anywhere on the substrate.

d. Substrate is sloped as indicated to provide positive drainage.

e. Walls and vertical surfaces are constructed to receive counter flashing, and will permit nailing of the base flashing materials.

f. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of felts, edging strips, gravel stops, and roof fixtures. Surface-applied nailers are the same thickness as the roof insulation.

g. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than nominal 4 inches. Cants are constructed of treated wood or wood fiberboard roof insulation.

h. Venting is provided in accordance with the following:

(1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.

i. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. Insulation is being roofed over on the same day the insulation is installed.

j. Cast-in-place substrates have been allowed to cure and the surface dryness requirements specified under paragraph entitled "Field Quality Control" have been met.

3.2 PREPARATION

3.2.1 Protection of Property

3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings not less than six inches, secure against wind, and vent to prevent collection of

moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

3.2.1.2 Flame-Heated Equipment

Do not place flame-heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame-heated equipment and on the roof.

3.2.1.3 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

3.2.2 Priming of Surfaces

Prime surfaces at the rate of 0.75 gallon per 100 sq. ft. or as recommended by modified bitumen sheet manufacturer's printed instructions and allow to dry.

3.2.2.1 Priming of Metal Surfaces

Prime flanges of metal edging strips, prior to stripping into roofing system in accordance with modified bitumen manufacturer's printed instructions and allow to dry.

3.2.3 Heating of Asphalt

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Kettles shall have visible thermometer and thermostatic controls set to the temperature limits specified herein. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus 2 degrees F, to check temperatures of the asphalt frequently. When temperatures exceed maximums specified, remove asphalt from the site. Do no permit cutting back, adulterating, or fluxing of asphalt.

3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by manufacturer's printed application instructions and approved by the Contracting Officer. Keep roofing materials dry before and during application. Do not permit phased construction.Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. Modified Bitumen Base Sheet shall not remain exposed prior to application of the Modified Bitumen Cap Sheet. A hand-held thermometer in required on the roof at all times during roofing installation to check EVT of asphalt.

3.3.1 Base Sheet

Apply base sheets in shingle fashion in hot mopping of asphalt. On nailable substrates, mechanically fasten base sheet in conformance with FM requirements and membrane manufacturer's printed instructions. Where applicable, base sheet may be mechanically fastened in conjunction with

insulation to the substrate, in accordance with membrane manufacturers printed instructions. Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 2 inches unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 6 inches and staggered a minimum of 36 inches. Apply sheets at right angles to the roof slope so that the direction of water flow is over and not against the laps. Extend sheets approximately 2 inches above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim felt to a neat fit around vent pipes, roof drains, and other projections through the roof.Application shall be free of ridges, wrinkles, and buckles or other voids.

3.3.2 Hot-Mopping of Base Sheets

Provide hot asphalt for embedding of base sheets, including modified bitumen base sheet, to the substrate.Apply base sheets immediately following application of hot asphalt. Do not work ahead with asphalt.Asphalt shall be completely fluid, with mop temperatures within the specified EVT range, at the instant base sheets come into contact with asphalt. Application of bitumen between plies shall be such as to provide full, continuous, uniform coverage and complete penetration of asphalt into the sheet above and below. Embed sheets in asphalt. As sheets are being rolled into hot asphalt, immediately and thoroughly squeegee, roll, or broom down to eliminate trapped air and to provide tight, smooth laminations without wrinkles, buckles, kinks, and fish mouths. Completed system shall be free of air pockets, blisters and other voids.

3.3.2.1 Temperature Limitations for Asphalt

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its FBT. Do not heat asphalt between 500 and 525 degrees F for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed base sheets when temperature of asphalt is within plus or minus 25 degrees F of the equiviscous temperature (EVT). Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP, FBT, and EVT of the asphalt used.

3.3.3 Modified Bitumen Sheets

Sheets shall be watertight and visually free of pinholes, particles of foreign matter, undispersed raw material, or other manufacturing defects that might affect serviceability. Edges of seams shall be straight and flat so that they may be seamed to one another without forming fish mouths, wrinkles or other voids.

3.3.3.1 SBS Modified Bitumen Sheets

Solid mop top surface of base sheet with hot asphalt at the rate of 25 pounds per 100 sq. ft. and embed one layer of roofing membrane into hot asphalt. Roll modified bitumen roofing membrane into place with a flow of hot asphalt out of side and end laps. Side laps shall be 4 inches and end laps shall be 6 inches or as recommended by the manufacturer. Stagger end laps a minimum of 36 inches. Back mop end laps. Apply roofing in a

continuous application. Start installation at the low point of the roof and progress to the high point. Provide tight, smooth laminations without wrinkles, ridges, buckles, kinks, and fishmouths. Completed system shall be free of air pockets, blisters, ridges, fishmouths, and open laps.

3.3.4 Flashings

Two piles of flashing are required. First ply of equal or greater thickness as the base sheet, and second ply of equal or greater thickness as the cap sheet. Apply granular surfaced modified bitumen sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, in accordance with membrane manufacturer's printed application instructions and where necessary to make the work watertight. Metal flashing collars and cap flashings are specified under Section 07 60 00, "Flashing and Sheet Metal." Do not set metal flashing in hot asphalt.

3.3.5 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.3.6 Protection of Applied Roofing Against Moisture Absorption

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system as follows.

3.3.6.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation boards and seal the terminated edge of modified bitumen roofing system with two full width strips of roofing felt set in and coated with asphalt roof cement. One-half width of the strips shall extend up and over the finished roofing and the other half-width extended out onto the bare deck unless recommended otherwise in membrane manufacturer's printed application instructions. Seal off flutes in metal decking along the cutoff edge. Pull membrane free/loose or cut to expose the insulation when resuming work, and remove the insulation boards used for fill-in.

3.3.6.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Temporary flashings shall consist of one ply of ply felt applied in a trowel coat of asphalt roof cement applied to a primed surface, and finished with a surface coat of asphalt roof cement. Remove temporary flashing before applying permanent flashing.

3.3.6.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.4 INFORMATION CARD

For each roof type, furnish a typewritten card, a photoengraved 0.032 inch thick aluminum card for exterior display. Card shall be 8 1/2 by 11 inches minimum and shall contain the information listed on Form 1 located at end of this section. Install card near point of access to roof, or as instructed by the Government.

FORM 1, ROOFING SYSTEM DESCRIPTION

1. Location _____ 2. Bldg. Name _____

3. Bldg. No. _____ 4. Roof Area (SF) _____ 5. Contract No. _____

6. New Construction: ( ) Yes ( ) No 7. Deck Slope: _____

8. Type of Deck:
   ( ) Metal
   ( ) Cast-In-Place Concrete
   ( ) Precast/Prestressed Concrete
   ( ) Wood Plank or Plywood
   ( ) Other _____

9. Type of Insulation Board:
   ( ) Polyisocyanurate/Composite
   ( ) Polystyrene/Composite
   ( ) Perlite
   ( ) Other _____
   ( ) Polyisocyanurate Foam
   ( ) Polystyrene
   ( ) Mineral Fiber

10. Insulation Manufacturer: _____

11. Insulation Thickness: _____

12. Vapor Treatment: Total coverage ( ) Yes ( ) No
    ( ) No Vapor Retarder
    ( ) One Way Roof Vents
    ( ) Other _____
    ( ) Bituminous Vapor Retarder
    ( ) Laminated Kraft Paper

13. Vapor Treatment Manufacturer(s): _____

14. Roofing Type:
    ( ) Built-Up (Asphalt)
    ( ) Built-Up (Coal-Tar)
    ( ) Metal
    ( ) Shingles
    ( ) PIB
    ( ) Modified Bitumen
    ( ) CSPE
    ( ) Other _____
    ( ) TPA
    ( ) EPDM
    ( ) PVC

15. Roofing Manufacturer: _____

16. Roofing Installer/Warrantor: _____

17. Roofing Application Method:
    ( ) Bitumen ( ) Fully Adhered ( ) Loose-Laid
    ( ) Mechanically Fastened ( ) Torched Ballasted
    ( ) Mechanically Fastened/Fully Adhered ( ) Other _____

18. Warranty Period: From _____ To _____

19. Warranty Serial Number: _____

20. Date Roofing Completed: _____ 21. Inspector: _____

22. Prime Contractor Name/Address: _____

Signature: _____ Date: _____

INSTRUCTIONS FOR FORM 1 (Do Not Post)

1. Location: Name of activity as shown on contract.

2. Bldg. Name: As shown on contract or as provided by Contracting Officer.

3. Bldg. Number: As provided by Contracting Officer.

4. Roof Area: Area in square feet of roof for which deck insulation, membrane, etc. are the same. A separate form is required if any part of roof system is different over other areas of the roof.

5. Contract Number: As shown on the contract.

7. Show deck slope.

8. Deck: Check appropriate block.

9. Type of Insulation Board: Check appropriate block.

11. Show minimum thickness of installed insulation.

12. Vapor Treatment: Check appropriate blocks.

13. Show vapor treatment system manufacturer's name.

14. Roofing Type: Check appropriate block.

15. Show roofing manufacturer's name.

16. Roofing Installer's or Contractor's name.

17. Roofing Application Method: Check appropriate block.

18. Warranty Period: Insert start and end dates.

20. Show date roofing was accepted by the Contracting Officer. Warranty period begins on this date.

21. Show Government Inspector's name.

22. Prime Contractor Name/Address/Signature: Must be signed and dated by QC Manager.

-- End of Section --

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M	(2008) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B101	(2007) Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B69	(2011) Standard Specification for Rolled Zinc
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 4586	(2007) Asphalt Roof Cement, Asbestos-Free
ASTM D41/D41M	(2011) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793 (2003) Architectural Sheet Metal Manual, 6th Edition

1.2 GENERAL REQUIREMENTS

Finished sheet metalwork will form a weathertight construction without waves, warps, buckles, fastening stresses or distortion, which allows for expansion and contraction. Sheet metal mechanic is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous roofing operations.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gutters;

Downspouts;

Expansion joints;

Gravel stops and fascias;

Splash pans;

Base flashing;

Counterflashing;

Flashing at roof penetrations;

Drip edge;

Eave flashing;

Indicate thicknesses, dimensions, fastenings and anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.4 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition as determined and instructed by the COR. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA Arch. Manual for a particular item, unless otherwise specified or indicated. Conform to the requirements specified and to the thicknesses and configurations established in SMACNA Arch. Manual for the materials. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items must be copper.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used except as follows:

2.1.1 Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fascias; cap, valley, steeped, base, and eave flashings, and related accessories.

2.1.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.1.3 Copper, Sheet and Strip

ASTM B370, cold-rolled temper, H 00 (standard).

2.1.4 Lead-Coated Copper Sheet

ASTM B101.

2.1.5 Lead Sheet

Minimum weight 4 pounds per square foot.

2.1.6 Steel Sheet, Zinc-Coated (Galvanized)

ASTM A653/A653M.

2.1.6.1 Finish

Exposed exterior items of zinc-coated steel sheet must have a baked-on, factory-applied color coating of polyvinylidene fluoride or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and

pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color to match adjacent material.

2.1.7 Zinc Sheet and Strip

ASTM B69, Type I, a minimum of 0.024 inch thick.

2.1.8 Stainless Steel

ASTM A167, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

2.1.9 Aluminum Alloy Sheet and Plate

ASTM B209 color to match adjacent material form alloy, and temper appropriate for use.

2.1.9.1 Alclad

When fabricated of aluminum, fabricate the items Alclad 3003, Alclad 3004, Alclad 3005, clad on both sides unless otherwise indicated.

a. Gutters, downspouts, and hangers

b. Gravel stops and fascias

c. Flashing

2.1.9.2 Finish

Exposed exterior sheet metal items of aluminum must have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color of to match adjacent material.

2.1.10 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B221.

2.1.11 Solder

ASTM B32, 95-5 tin-antimony.

2.1.12 Bituminous Plastic Cement

ASTM D 4586, Type I.

2.1.13 Roofing Felt

ASTM D 226/D 226M Type I.

2.1.14 Asphalt Primer

ASTM D41/D41M.

2.1.15 Fasteners

Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.2 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inch. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work.

3.1.3 Cleats

Provide cleats for sheet metal 18 inch and over in width. Space cleats evenly not over 12 inch on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of 2 inch wide by 3 inch long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. Pretin cleats for soldered seams.

3.1.4 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inch or less in thickness.

3.1.5 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.5.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

3.1.5.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

3.1.5.3 Loose-Lock Expansion Seams

Not less than 3 inch wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 1/8 inch thick bed.

3.1.5.4 Flat Seams

Make seams in the direction of the flow.

3.1.6 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pretin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.6.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pretinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.7 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.7.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

3.1.7.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inch maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inch from the end of the overlapping sheet.

3.1.8 Protection from Contact with Dissimilar Materials

3.1.8.1 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.8.2 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.8.3 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.9 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascias by expansion and contraction joints spaced not more than 12 feet apart.

3.1.10 Base Flashing

Extend up vertical surfaces of the flashing not less than 8 inch and not less than 4 inch under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 6 inch. Overlap the flashing strips with the previously laid flashing not less than 3 inch. Fasten the strips at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 6 inch on center with hex headed, galvanized shielded screws a minimum of 2-inch lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of curbs and similar vertical surfaces, extending through sloping roofs, the metal flashings. Extend the metal flashings onto the roof covering not less than 4.5 inch at the lower side of vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Provide factory-fabricated base flashing for interior and exterior corners.Do not use metal base flashing on built-up roofing.

3.1.11 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inch above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inch. Fold the exposed edges of counterflashings 1/2 inch. Where stepped counterflashings are required, they may be installed in short lengths a minimum 8 inch by 10 inch or may be of the preformed one-piece type. Provide end laps in counterflashings not less than 3 inch and make it

weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 10 feet. Form the flashings to the required shapes before installation. Factory-form the corners not less than 12 inch from the angle. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inch into the walls. Install counterflashing to provide a spring action against base flashing.

3.1.12 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1 1/4 inch, as approved.

3.1.12.1 Caulked Reglets

Provide with rounded edges and metal strap brackets or other anchors for securing to the concrete forms. Provide reglets with a core to protect them from injury during the installation. Provide built-up mitered corner pieces for internal and external angles.Wedge the flashing in the reglets with lead wedges every 18 inch, caulked full and solid with an approved compound.

3.1.12.2 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snaplock receiver. Insert the flashing the full depth of the slot and lock by indentations made with a dull-pointed tool, wedges, and filled with a sealant. For friction reglets, install flashing snaplock receivers at 24 inch on center maximum. When the flashing has been inserted the full depth, caulk the slot and lock and fill with sealant.

3.1.13 Metal Drip Edge

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inch and secure with compatible nails spaced not more than 10 inch on center along upper edge.

3.1.14 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation.Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in sections not less than 8 feet.Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inch minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets.Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on by cleats spaced not less than 36 inch apart. Adjust gutters to slope uniformly to outlets,

with high points occurring midway between outlets. Fabricate hangers and fastenings from metals.

3.1.15 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the masonry or steel substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

3.1.15.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

3.1.16 Splash Pans

Install splash pans where downspouts discharge on roof surfaces and at other locations as indicated. Unless otherwise shown, provide pans not less than 24 inches long by 18 inches wide with metal ribs across the bottom of the pan. Form the sides of the pan with vertical baffles not less than one inch high in the front, and 4 inches high in the back doubled over and formed continuous with horizontal roof flanges not less than 4 inches wide. Bend the rear flange of the pan to contour of cant strip and extend up 6 inches under the side wall covering or to height of base flashing under counterflashing. Bed the pans and roof flanges in plastic bituminous cement and strip-flash as specified.

3.1.17 Eave Flashing

One piece in width, applied in 8 to 10 foot lengths with expansion joints spaced as specified in paragraph entitled "Expansion and Contraction." Provide a 3/4 inch continuous fold in the upper edge of the sheet to engage cleats spaced not more than 10 inches on center. Locate the upper edge of flashing not less than 18 inch from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with one inch flat locked joints with cleats that are 10 inches on center.

3.1.18 Expansion Joints

Provide expansion joints for roofs, walls, and floors as indicated. Provide expansion joints in continuous sheet metal at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum, aluminum gravel stops and fascias which must have expansion joints at not more than 12 foot spacing. Provide evenly spaced joints. Provide an additional joint where the distance between the last expansion joint and the end of the continuous

run is more than half the required interval spacing. Conform to the requirements of Table I.

3.1.18.1 Roof Expansion Joints

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Bituminous base flashing is specified in Roofing Section. Provide counterflashing as specified in paragraph "Counterflashing," except as follows: Provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than one inch for flashing on one side of the expansion joint and be less than the width of the expansion joint plus one inch for flashing on the other side of the joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

3.1.19 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck. Goose-necks, rainhoods, and power roof ventilators are specified in 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS.

3.1.20 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inch on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inch. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inch roof flange in bituminous plastic cement and nailed 3 inch on center. Extend sleeve a minimum of 8 inch above the roof deck and lapped a minimum of 3 inch by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

3.2 PAINTING

Field-paint sheet metal for separation of dissimilar materials.

3.2.1 Aluminum Surfaces

Shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification that specified material is provided and installed.

c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

Sheet Metal Items	Aluminum, Inch	Stainless Steel, Inch	Zinc-Coated Steel, U.S. Std. Gage
Building Expansion Joints			
Cover.....	.032	.015	24
Downspouts and leaders	.032	.015	24
Downspout clips and anchors	.040 clip	-	-
	.125 anchor	-	-
Downspout straps, 2-inch	.060	.050	-
Flashings:			
Base	.040	.018	24
Cap (Counter-flashing)	.032	.015	26
Eave	-	.015	24
Pipe vent sleeve(d)			

Gravel stops and fascias:			
Extrusions	.075	-	-
Sheets, smooth	.050	.018	24
Edge strip	.050	.025	-
Gutters:			
Gutter section.....	.032	.015	24
Continuous cleat.....	.032	.015	24
Hangers, dimensions	1 inch by .080 inch (c)	1 inch by .037 inch	-
Joint Cover plates... (See Table II)	.032	.015	24
Reglets (c)	-	.010	-
Splash pans	.040	.018	-

(a) Brass.

(b) May be lead weighing 4 pounds per square foot.

(c) May be polyvinyl chloride.

(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph entitled "Single Pipe Vents" for optional material.

TABLE II. SHEET METAL JOINTS

Item Designation	TYPE OF JOINT		
	Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	1.25 inch single lock, standing seam, cleated	1.25 inch single lock, standing	- - -
Flashings			
Base	One inch 3 inch lap for expansion joint	One inch flat locked, soldered; sealed; 3 inch lap for expansion joint	Aluminum producer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound

			compound.
Cap-in reglet	3 inch lap	3 inch lap	Seal groove with joint sealing compound.
Reglets	Butt joint	- - -	Seal reglet groove with joint sealing compound.
Eave	One inch flat locked, cleated One inch loose locked, expansion joint cleated	One inch flat locked, locked, cleated one inch loose locked, sealed expansion joints, cleated	Same as base flashing.
Edge strip	Butt	Butt	- - -
Gravel stops:			
Extrusions	- - -	Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing backup plate.
Gutters	1.5 inch lap, riveted and soldered	One inch flat locked, riveted, and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.

(a) Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.

(b) Seal polyvinyl chloride reglet with manufacturer's recommended sealant.

-- End of Section --

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 119	(2011) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E 1399	(1997; R 2009) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E 1966	(2007) Fire-Resistive Joint Systems
ASTM E 2174	(2010a) Standard Practice for On-Site Inspection of Installed Fire Stops
ASTM E 2307	(2010) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E 2393	(2010a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
ASTM E 814	(2011a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
FM AS 4991	(2001) Approval of Firestop Contractors

UNDERWRITERS LABORATORIES (UL)

UL 1479	(2003; Reprint Mar 2010) Fire Tests of Through-Penetration Firestops

UL 2079	(2004; Reprint Jun 2008) Tests for Fire Resistance of Building Joint Systems
UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 General

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.

b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2.2 Sequencing

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.2.3 Submittals Requirements

a. Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are

to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

b. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification from UL of passing the "Aging and Environmental Exposure Testing " portion of UL 1479.

c. Submit documentation of training and experience for Installer.

d. Submit manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials;

SD-07 Certificates

Firestopping Materials

Installer Qualifications;

Inspection;

1.4 QUALITY ASSURANCE

1.4.1 Installer

Engage an experienced Installer who is:

a. FM Research approved in accordance with FM AS 4991, operating as a UL Certified Firestop Contractor, or

b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer written certification of training, and retain proof of certification for duration of firestop installation.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements. Remove damaged or deteriorated materials from the site.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic, water-based, noncombustible products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment. Firestop material must be free from Ethylene Glycol, PCB, MEK, or other types of hazardous chemicals.

2.1.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SYSTEM DESCRIPTION, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = Rating of wall or partition being penetrated.

b. Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = 1 hour, T Rating = 1 hour. Where the penetrating item is outside of a wall cavity the F rating and T rating must be equal to the fire resistance rating of the floor penetrated.

c. Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = 1 hour, T Rating = 1 hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SYSTEM DESCRIPTION, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur, as follows: construction joints in walls, 1 hour; construction joints in floors, 1 hour; gaps between floor slabs and curtain walls, 1 hour; gaps between top of the walls and the bottom of roof and floor decks, 1 hour, and provide L rating of <5 cfm/lf where required. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E 2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.1.4 Material Performance

All firestop materials are subject to these minimum standards of performance.

a. Firestop material shall be capable of installation at temperatures of 35 to 120 degrees F.

b. Material must be able to be frozen, thawed and still maintain manufacturer approval for installation.

c. Firestop material must convey a manufacturer's written warranty guaranteeing the performance of the material for the sustainable lifetime of the structure.

d. Material must maintain a shelf life of no less than 2 years form date of manufacturing.

e. Acceptable firestop cast-in-place devices are factory assembled intumescent lined round or oval plastic cylinders capable of protecting plastic, metallic, cable, and blank openings through the cast-in-place device equal to the fire-resistance rating of the floor.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products. Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0% to 100% visual fill of penetrants; while maintaining "L" rating of <5 cfm/sf measured at ambient temperature and 400* F at 0% to 100% visual fill. Each device must be capable of retrofit applications and be available in square and round configurations, with single, double, triple and six-plex bracket systems provided. Firestop devices must also allow for plastic pipe, metallic pipe, and mixed multiple

penetrations plastic, metallic, insulated metallic, and cable through a single device.

3.3 INSPECTION

3.3.1 General Requirements

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the manufacturer's technical representative. The manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.3.2 Inspection Standards

Inspect all firestopping in accordance to ASTM standards for firestop inspection, and document inspection results to be submitted to the Owner.

a. ASTM E 2393

b. ASTM E 2174

-- End of Section --

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C734	(2006) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C919	(2008) Use of Sealants in Acoustical Applications
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 217	(2010) Cone Penetration of Lubricating Grease
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). Provide a copy of the Material Safety Data Sheet for each solvent, primer or sealant material.

SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 90 degrees F or less than 0 degrees F.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility with Substrate

Verify that each of the sealants is compatible for use with joint substrates.

1.5.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6 SPECIAL WARRANTY

Guarantee sealant joint against failure of sealant and against water penetration through each sealed joint for five years.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

2.1.1 Interior Sealant

Provide ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant for the following:

	LOCATION	COLOR
a.	Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.	Match adjacent surface color
b.	Perimeter of frames at doors, windows and access panels which adjoin exposed	Match adjacent surface color

interior concrete and masonry surfaces.

c.	Joints between edge members for acoustical tile and adjoining vertical surfaces.	Match adjacent surface color
d.	Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	Match adjacent surface color
e.	Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	Match adjacent surface color
f.	Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	Match adjacent surface color

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

	LOCATION	COLOR
a.	Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b.	Joints between new and existing exterior masonry walls.	Match adjacent Surface color
c.	Masonry joints where shelf angles occur.	Match adjacent surface color
d.	Expansion and control joints.	Match adjacent surface color
e.	Voids where items pass through exterior walls.	Match adjacent surface color
f.	Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match adjacent surface color
g.	Metal-to-metal joints where sealant is indicated or specified.	Match adjacent surface color
h.	Joints between ends of gravel stops, fascias, copings, and adjacent walls.	Match adjacent surface color

2.1.3 Floor Joint Sealant

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

	LOCATION	COLOR
a.	Seats of metal thresholds for exterior doors.	Gray
b.	Control and expansion joints in floors, slabs, ceramic tile, and walkways.	Gray

2.1.4 Acoustical Sealant

Rubber or polymer-based acoustical sealant conforming to ASTM C919 must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant must have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734, and must be non-staining.

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 BACKSTOPS

Provide glass fiber roving or polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Make backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.4.1 Rubber

Conform to ASTM D 1056, Type 2, closed cell, Class A, Grade NS, round cross section for cellular rubber sponge backing.

2.4.2 Synthetic Rubber

Conform to ASTM C509, Option I, Type I preformed rods or tubes for Synthetic rubber backing.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean surfaces from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, contact sealant manufacturer for specific recommendations.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity.

3.1.4 Wood Surfaces

Keep wood surfaces to be in contact with sealants free of splinters and sawdust or other loose particles.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

a. Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry,		

stone:

1/4 inch (minimum)	1/4 inch	1/4 inch
Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
Over 1/2 inch to 2 inch	1/2 inch	5/8 inch
Over 2 inch.	(As recommended by sealant manufacturer)	

b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is not required on metal surfaces.

3.3.2 Masking Tape

Place masking tape on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Remove masking tape within 10 minutes after joint has been filled and tooled.

3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

a. Where indicated.

b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios".

3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and cannot be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the

joints solidly without air pockets. Tool sealant after application to ensure adhesion. Make sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Apply sealer over the sealant when and as specified by the sealant manufacturer.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- End of Section --

SECTION 08 11 13 STEEL

DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A879/A879M	(2006) Standard Specification for Steel Sheet, zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C578	(2011a) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2011) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM D2863	(2010) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115	(2006) Hardware Preparation in Steel Doors and Steel Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105	(2010) Standard for Installation of Smoke Door Assemblies and Other Opening Protectives
NFPA 252	(2008) Standard Methods of Fire Tests of Door Assemblies
NFPA 80	(2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111	(2009) Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories
SDI/DOOR 113	(2001; R2006) Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies
SDI/DOOR A250.11	(2001) Recommended Erection Instructions for Steel Frames
SDI/DOOR A250.3	(2007) Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
SDI/DOOR A250.4	(2001) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
SDI/DOOR A250.6	(2003; R2009) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
SDI/DOOR A250.8	(2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C	(2009) Standard for Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors;

Frames;

Weatherstripping

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors;

Schedule of frames;

Submit door and frame locations.

SD-03 Product Data

Doors;

Frames;

Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated. Provide exterior glazing in accordance with ASTM F 2248 and ASTM E1300.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors and for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

2.1.1.2 Maximum Duty Doors

SDI/DOOR A250.8, Level 4, physical performance Level A, Model 1 with core construction as required by the manufacturer for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level 4 at all exterior doors.

2.2 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with SDI/DOOR A250.4 and shall have met the requirements for Level C. Prepare doors to receive specified hardware.Doors shall be 1-3/4 inch thick. Provide insulated steel doors and frames at all exterior doors.

2.3 ACCESSORIES

2.3.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors. For interior pairs of fire rated and smoke control doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies and NFPA 105 for smoke control assemblies.

2.3.2 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or

b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or

c. Mineral board: ASTM C612, Type I.

2.5 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 3 and 4, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth. Provide at all exterior doors.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

2.5.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.5.3 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and be a member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.5.4 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.5.5 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.5.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;

b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;

c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111; and

2.5.6.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

2.6 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 shall take precedence over details indicated or specified.

2.6.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.6.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

2.6.3 Astragal on Fire and Smoke Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. On smoke control doors, conform to NFPA 105.

2.7 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

2.7.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08 71 00 DOOR HARDWARE. Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.8 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.9 FINISHES

2.9.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8, or paintable A25 galvannealed steel without primer. Where coating is removed by welding, apply touchup of factory primer.

2.9.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A924/A924Mand ASTM A653/A653M. The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8. Provide for exterior doors.

2.9.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A879/A879M, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

2.9.4 Factory-Applied Enamel Finish

Coatings shall meet test procedures and acceptance criteria in accordance with SDI/DOOR A250.3. After factory priming, apply two coats of medium-gloss enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements shall be in accordance with the

coating manufacturer's recommendations. Color(s) of finish coat shall be as indicated and shall match approved color sample(s).

2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

2.11 PROVISIONS FOR GLAZING

Materials are specified in Section 08 81 00, GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. Backfill frames with mortar. Coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean

thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

SECTION 08 11 16 ALUMINUM

DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural

Exterior doors, frames and hardware shall be designed to resist equivalent static design loads in accordance with ASTM F 1642. Frame deflections shall not exceed L/160 of the unsupported member lengths. Equivalent static design loads for connections of window or door frame to the surrounding walls or hardware and associated connections, and glazing stop connections shall be in accordance with ASTM F 2248 and ASTM E1300.Design supporting elements and their connections based on their ultimate capacities. Provide calculations of a Professional Engineer that substantiates compliance with these requirements. Use frames that provide an equivalent level of performance. Shapes and thicknesses of framing members shall be sufficient to withstand a design wind load of not less than50 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide glazing beads, moldings, and trim of not less than 0.050 inch nominal thickness.

1.2.2 Air Infiltration

When tested in accordance with ASTM E283, air infiltration shall not exceed 0.06 cubic feet per minute per square footof fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).

1.2.3 Water Penetration

When tested in accordance with ASTM E331, there shall be no water penetration at a pressure of 8 pounds per square foot of fixed area.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors, windows and frames;

Show elevations of each door type, size of doors and frames, metal gages, details of door and frame construction, methods of anchorage, glazing details, weatherstripping, provisions for and location of hardware, and details of installation.

SD-04 Samples

Finish sample;

SD-05 Design Data

Structural calculations for deflection;

SD-08 Manufacturer's Instructions

Doors and frames

Submit detail specifications and instructions for installation, adjustments, cleaning, and maintenance.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on nonabsorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

1.5 QUALITY CONTROL

1.5.1 Shop Drawing Requirements

Drawings shall indicate elevations of doors, windows and frames, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, trim, installation details, and other related items.

1.5.2 Sample Requirements

1.5.2.1 Finish Sample Requirements

Submit color chart of standard factory-finish color coatings.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members, subframes, adjoining sidelights, adjoining window wall, trim, and accessories.

2.2 MATERIALS

2.2.1 Anchors

Stainless steel.

2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.2.3 Aluminum Alloy for Doors and Frames

ASTM B221, Alloy 6063-T5 for extrusions. ASTM B209, alloy and temper best suited for aluminum sheets and strips.

2.2.4 Fasteners

Hard aluminum or stainless steel.

2.2.5 Structural Steel

ASTM A36/A36M.

2.2.6 Aluminum Paint

Aluminum door manufacturer's standard aluminum paint.

2.3 FABRICATION

2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 12 inches on center. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

2.3.2 Aluminum Doors

Of type, size, and design indicated and not less than 1-3/4 inch thick. Minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal and shall include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor. Bevel single-acting doors 0.063 or 0.125 inch at lock, hinge, and meeting stile edges.

2.3.2.1 Full Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 3/8 or 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Weld concealed reinforcements for hardware in place.

2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively. Air leakage of a single leaf weatherstripped door shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill. Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation. Place anchors near top and bottom of each jamb and at intermediate points not more than 25 inch apart.

2.3.6 Provisions for Hardware

Coordinate with Section 08 71 00 DOOR HARDWARE. Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws.

2.3.7 Provisions for Glazing

Provide extruded aluminum snap-in glazing beads on interior side of doors. Glazing beads shall have vinyl insert glazing gaskets. Design glazing beads to receive glass of thickness indicated or specified.

2.3.8 Finishes

Provide exposed aluminum surfaces with factory finish of anodic coating.

2.3.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45. Finish shall be clear (natural), designation AA-M10-C22-A41, Architectural Class I 0.7 mil or thicker).

PART 3 EXECUTION

3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors, adjoining sidelights, and adjoining window walls. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions. Anchor bottom of each frame to rough floor construction with 3/32 inch thick stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Hang doors to produce clearances specified in paragraph entitled "Aluminum Doors," of this section. After erection and glazing, adjust doors and hardware to operate properly.

3.2 PROTECTION FROM DISSIMILAR MATERIALS

3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact to dissimilar metals.

3.2.1.1 Protection

Provide one of the following systems to protect surfaces in contact with dissimilar metals:

a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.

b. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.

c. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.

d. Use a nonabsorptive tape or gasket in permanently dry locations.

3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint to prevent aluminum discoloration.

3.2.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

3.2.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting the aluminum, the Contractor shall have the option of painting the wood or other absorptive surface with two coats of aluminum paint and sealing the joints with elastomeric sealant.

3.3 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's written recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

3.4 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10	(2010; Change 2010; Change 2011) Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE FUN IP	(2009; Errata 2010) Fundamentals Handbook, I-P Edition

ASME INTERNATIONAL (ASME)

ASME B29.400	(2001; R 2008) Combination, "H" Type Mill Chains, and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A27/A27M	(2010) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A48/A48M	(2003; R 2008) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666	(2010) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F 568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA MG 1	(2009) Motors and Generators
NEMA ST 1	(1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 DESCRIPTION

Overhead coiling doors to be counterbalanced doors by methods of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members. Doors to be coiling type, with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Wind Loading

Design and fabricate door assembly to withstand the wind loading pressure of at least 50 pounds per square foot with a maximum deflection of 1/120 of the opening width. Provide test data showing compliance with ASTM E 330. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested Complete assembly must meet or exceed the requirements of ASCE 7-10.

1.3.2 Operational Cycle Life

All portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue must be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Provide fabrication drawings that show complete assembly with hardware and framing details for the following items:

Overhead Coiling Doors

Counterbalancing Mechanism

Manual Door Operators

Electric Door Operators

Bottom Bar

Guides

Mounting Brackets

Overhead Drum

Hood

Painting

Submit Installation Drawings in accordance with paragraph entitled, "Overhead Coiling Door Assemblies," of this section.

SD-03 Product Data

Submit manufacturer's catalog data for the following items listing all accessories including supports, locks and latches, and weather stripping.

Overhead Coiling Doors

Manual Door Operators

Electric Door Operators

Fire-Rated Door Assembly

SD-05 Design Data

Submit equipment and performance data for the following items in accordance with the paragraph entitled, "Performance Requirements," of this section.

Overhead Coiling Doors

Manual Door Operators

Electric Door Operators

Fire-Rated Door

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies.

1.5 OVERHEAD COILING DOOR DETAIL SHOP DRAWINGS

Provide installation drawings for overhead coiling door assemblies which show elevations of each door type, shape and thickness of materials, finishes, details of joints and connections, and details of guides and fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Show locations of replaceable fusible links wiring diagrams for power, signal and controls. Include a schedule showing the location of each door with the drawings.

Contractor must submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the Overhead Coiling Door Assemblies. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

Provide operation and maintenance manuals which are consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Provide test data that is legible and of good quality.

1.6 WARRANTY, OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies, including the following items:

Materials

Devices

Manual Door Operators

Electric Door Operators

Hood

Procedures

Manufacture's Brochures

Parts Lists

Contractor must furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship and that they will remain so for not less than two years after completion and acceptance of the project.

Contractor must warrant that upon notification by the Government, he will immediately make good any defects in material, workmanship, and door operation within the same time period covered by the guarantee, at no cost to the Government.

1.7 DELIVERY AND STORAGE

Delivered doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

PART 2 PRODUCTS

2.1 OVERHEAD COILING DOORS

2.1.1 Curtain Materials and Construction

Provide curtain slats which are fabricated from steel sheets conforming to ASTM A653/A653M, Grade A, with the additional requirement of a minimum yield point of 33,000 psi. Provide sheets which are galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M.

Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Provide slats which are continuous without splices for the width of the door.

Provide slats filled with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces on interior surface of slats.

2.1.2 Insulated Curtains

Form Curtains from manufacturer's standard shapes of interlocking slats. Supply slat system with a minimum R-value of 4 when calculated in accordance with ASHRAE FUN IP. Slats to consist of a polystyrene core not less than 11/16 inch thick, completely enclosed within metal facings. Exterior face of slats must be the same gauge as specified for curtains.

Interior face must be not lighter than 0.0219 inches. The insulated slat assembly is to have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.

2.1.3 Curtain Bottom Bar

Curtain bottom bars must be pairs of angles from the manufacturer's standard steel, stainless and aluminum extrusions not less than 2.0 by 2.0 inches by 0.188 inch.Steel extrusions must conform to ASTM A36/A36M. Stainless steel extrusions conforming to ASTM A666, Type 304. Galvanize angles and fasteners in accordance with ASTM A653/A653M and ASTM A924/A924M. Coat welds and abrasions with paint conforming to ASTM A780/A780M.

2.1.4 Locks

Provide end and/or wind locks of cast steel conforming to ASTM A27/A27M, Grade B; galvanized in accordance with ASTM A653/A653M, ASTM A153/A153M and ASTM A924/A924M and secured at every other curtain slat.

2.1.5 Weather Stripping

Weather-stripping at the door-head and jambmust be 1/8-inch thick sheet of natural or neoprene rubber with air baffles, secured to the insides of hoods with galvanized-steel fasteners through continuous galvanized-steel pressure bars at least 5/8-inch wide and 1/8-inch thick.

Threshold weather-stripping must be 1/8-inch thick sheet natural or neoprene rubber secured to the bottom bars.

Provide weather-stripping of natural or neoprene rubber conforming to ASTM D 2000.

2.1.6 Locking Devices

Slide Bolt to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

Locking Device Assembly which includes cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

Provide Chain Lock Keeper which suitable for a standard padlock.

2.1.7 Safety Interlock

Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.1.8 Overhead Drum

Fabricate drums from nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.

2.2 HARDWARE

All hardware must conform to ASTM A153/A153M, ASTM A307, ASTM F 568M, and ASTM A27/A27M.

2.2.1 Guides

Fabricate curtain jamb guides from the manufacturer's standard angles or channels of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for track adjustment.

2.2.2 Equipment Supports

Fabricate door-operating equipment supports from the manufacturer's standard steel shapes and plates conforming to ASTM A36/A36M, galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M. Size the shapes and plates in accordance with the industry standards for the size, weight, and type of door installation.

2.3 COUNTERBALANCING MECHANISM

Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

2.3.1 Brackets

Provide the manufacturer's standard mounting brackets of either cast iron or cold-rolled steel with one located at each end of the counterbalance barrel conforming to ASTM A48/A48M.

2.3.2 Counterbalance Barrels

Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 inch per foot of span under full load.

2.3.3 Spring Balance

One or more oil-tempered, heat-treated steel helical torsion springs installed within the barrel capable of producing sufficient torque to assure easy operation of the door curtain. Provide and size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

2.3.4 Torsion Rod for Counter Balance

Fabricate rod from the manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

2.4 MANUAL DOOR OPERATORS

2.4.1 Manual Chain-Hoist Door Operators

Provide door operators which consist of an endless steel hand chain, chain-pocket wheel, guard, and a geared reduction unit of at least a 3 to 1 ratio with a maximum 25 lbf required pull for operation must not exceed 35 pounds.

Provide chain hoists to have a self-locking mechanism allowing the curtain to be stopped at any point in its upward or downward travel and to remain in that position until moved to the fully open or closed position. Provide hand chains of cadmium-plated alloy steel conforming to ASME B29.400. Yield point of the chain must be at least three times the required hand-chain pull.

Provide chain sprocket wheels of cast iron conforming to ASTM A48/A48M.

2.5 ELECTRIC DOOR OPERATORS

Provide electrical wiring and door operating controls conforming to the applicable requirements of NFPA 70.

Electric door-operator assemblies must be the sizes and capacities recommended and provided by the door manufacturer for specified doors. Assemblies must be complete with electric motors and factory-prewired motor controls, starter, gear reduction units, solenoid-operated brakes, clutch, remote-control stations, manual or automatic control devices, and accessories as required for proper operation of the doors.

Design the operators so that motors may be removed without disturbing the limit-switch adjustment and affecting the emergency auxiliary operators.

Provide a manual operator of crank-gear or chain-gear mechanisms with a release clutch to permit manual operation of doors in case of power failure. Arrange the emergency manual operator so that it may be put into and out of operation from floor level, and its use will not affect the adjustment of the limit switches. Provide an electrical or mechanical device which will automatically disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged.

2.5.1 Door-Operator Types

Provide an operator which is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

Provide an operator which is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

2.5.2 Electric Motors

Provide motors which are the high-starting-torque, reversible, constant-duty electrical type with overload protection of sufficient torque and horsepower to move the door in either direction from any position and produce a door-

travel speed of not less than 8 nor more than 12 inches per second without exceeding the horsepower rating.

Provide motors which conform to NEMA MG 1 designation, temperature rating, service factor, enclosure type, and efficiency to the requirements specified.

2.5.3 Motor Bearings

Bearings must be bronze-sleeve or heavy-duty ball or roller antifriction type with full provisions for the type of thrust imposed by the specific duty load.

Pre-lubricate and factory seal bearings in motors less than 1/2 horsepower.

Equip motors coupled to worm-gear reduction units with either ball or roller bearings.

Equip bearings in motors 1/2 horsepower or larger with lubrication service fittings. Fit lubrication fittings with color-coded plastic or metal dust caps.

In any motor, bearings that are lubricated at the factory for extended duty periods do not need to be lubricated for a given number of operating hours. Display this information on an appropriate tag or label on the motor with instructions for lubrication cycle maintenance.

2.5.4 Motor Starters, Controls, and Enclosures

Each door motor must have a factory-wired, unfused, disconnect switch; a reversing, across-the-line magnetic starter with thermal overload protection; 120-volt operating coils with a control transformer limit switch; and a safety interlock assembled in a NEMA ICS 6 type enclosure as specified herein. Control equipment must conform to NEMA ICS 2.

Provide adjustable switches, electrically interlocked with the motor controls and set to stop the door automatically at the fully open and fully closed position.

2.5.5 Control Enclosures

Provide control enclosures that conform to NEMA ICS 6 for oil-tight and dust-tight NEMA Type 13.

2.5.6 Transformer

Provide starters with 230/460 to 115 volt control transformers with one secondary fuse when it is required to reduce the voltage on control circuits to 120 volts or less. Provide transformer that conforms to NEMA ST 1.

2.5.7 Safety-Edge Device

Provide each door with a pneumatic safety device extending the full width of the door and located within a U-section neoprene or rubber astragal mounted on the bottom rail of the bottom door section. Device must immediately stop and reverse the door upon contact with an obstruction in the door opening

during downward travel and cause the door to return to full-open position. Safety device is not a substitute for a limit switch.

Connect safety device to the control circuit through a retracting safety cord and reel.

2.5.8 Remote-Control Stations

Provide interior remote control stations which are full-guarded, momentary-contact three-button, heavy-duty, surface-mounted NEMA ICS 6 type enclosures as specified. Mark buttons "OPEN," "CLOSE," and "STOP." The "CLOSE" button must be the type requiring a constant pressure to maintain the closing motion of the door. When the door is in motion and the "STOP" button is pressed, the door must stop instantly and remain in the stopped position; from the stopped position, the door may then be operated in either direction.

2.5.9 Speed-Reduction Units

Provide speed-reduction units consisting of hardened-steel worm and bronze worm gear assemblies running in oil or grease and encased in a sealed casing, coupled to the motor through a flexible coupling. Drive shafts must rotate on ball- or roller-bearing assemblies that are integral with the unit.

Provide minimum ratings of speed reduction units which are in accordance with AGMA provisions for class of service.

Ground worm gears to provide accurate thread form; machine teeth for all other types of gearing. Surface harden all gears.

Provide bearings which are the antifriction type equipped with oil seals.

2.5.10 Chain Drives

Provide roller chains that are power-transmission series steel roller type conforming to ASME B29.400, with a minimum safety factor of 10 times the design load.

Roller-chain side bars, rollers, pins, and bushings must be heat-treated or otherwise hardened.

Provide chain sprockets that are high-carbon steel with machine-cut hardened teeth, finished bore and keyseat, and hollow-head setscrews.

2.5.11 Brakes

Provide brakes which are 360-degree shoe brakes or shoe and drum brakes, solenoid-operated and electrically interlocked to the control circuit to set automatically when power is interrupted.

2.5.12 Clutches

Clutches must be the 4-inch diameter, multiple face, externally adjustable friction type or adjustable centrifugal type.

2.6 SURFACE FINISHING

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 GENERAL

Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, doors must be free from all distortion.

Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the contract documents and as required by the manufacturer.

Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

3.2 FIELD PAINTED FINISH

Steel doors and frames which are to be field painted must accordance with Section 09 90 00 PAINTS AND COATINGS and manufacturer's written instructions. Protect weather stripping from paint. Finishes must be free of scratches or other blemishes.

3.3 ACCEPTANCE PROVISIONS

After installation, adjust hardware and moving parts. Lubricate bearings and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

Adjust seals to provide weather-tight fit around entire perimeter.

Engage a factory-authorized service representative to perform startup service and checks according to manufacturer's written instructions.

Test the door opening and closing operation when activated by controls or alarm-connected fire-release system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset door-closing mechanism after successful test.

Test and make final adjustment of new doors at no additional cost to the Government.

3.3.1 Maintenance and Adjustment

Not more than 90 calendar days after completion and acceptance of the project, the Contractor must examine, lubricate, test, and re-adjust doors as required for proper operation.

3.3.2 CLEANING

Clean doors in accordance with manufacturer's approved instructions.

-- End of Section --

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

This Specification includes aluminum entrances, glass and glazing, door hardware, and components.

Type of Aluminum Entrance includes:

Impact Resistance Entrances; medium stile, 3-1/2 inch vertical face dimension, 1-3/4 inch depth, interior structural silicone glazed, high traffic/impact resistant applications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1503	(2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
AAMA 501	(2005) Methods of Test for Exterior Walls
AAMA 503	(2008) Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems
AAMA 800	(2010) Voluntary Specifications and Test Methods for Sealants

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2009; Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10	(2010; Change 2010; Change 2011) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B221M	(2007) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM E 1105	(2000; R 2008) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
ASTM E 1424	(1991; R 2008) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen
ASTM E 1886	(2005) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 783	(2002; R 2010) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.10	(2011) Power Operated Pedestrian Doors
ANSI/BHMA A156.4	(2008) Door Controls - Closers

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201 Safety Standard for Architectural Glazing Materials

UNDERWRITERS LABORATORIES (UL)

UL 325 (2002; Reprint Apr 2011) Door, Drapery, Gate, Louver, and Window Operators and Systems

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Entrance Performance Requirements

1.3.1.1 Air Infiltration

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. For single acting offset pivot, butt hung or continuous geared hinge entrances in the closed and locked position, test the specimen in accordance with ANSI/BHMA A156.10, and ASTM E 283 at a pressure differential of 1.57 psf for pairs of doors; maximum infiltration for a pair of 7 foot - 0 inch by 8 foot - 0 inch entrance doors and frame is 1.2 cfm/ft2.

b. Maximum allowable infiltration, for a completed storefront system is not to exceed 0.06 cfm/square foot when tested in accordance with ASTM E 1424 at differential static pressure of 6.24 psf.

1.3.1.2 Wind Loads

Provide completed storefront system capable of withstanding wind pressure loads, normal to the wall plane indicated, as follows:

a. Exterior Walls

(1) Positive Pressure: 50 psf

(2) Negative Pressure: 30 psf

b. Interior Walls: (pressure acting in either direction) 5 psf

1.3.1.3 Deflection

Submit certified test reports showing compliance with specified performance characteristics as follows:

The maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures is L/175 or 3/4 inches maximum.

1.3.1.4 Condensation Resistance and Thermal Transmittance Performance Requirements

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. U-Value Requirements:

(1) Perform test in accordance with AAMA 1503 procedure and on the configuration specified therein.

(2) Thermal Transmittance ("U" Value) maximum 0.65 (6250) BTU/hr/sf/deg F at 15 mph exterior wind.

b. CRF Class Requirements:

(1) Perform test in accordance with AAMA 1503.

(2) Condensation Resistance Factor Requirements (CRF) minimum 42.

1.3.1.5 Water Infiltration

Submit certified test reports showing compliance with specified performance characteristics as follows:

System is designed to provide no uncontrolled water when tested in accordance with ASTM E 331 at a static pressure of 8 psf.

1.3.2 Structural

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. Corner strength per dual moment load test procedure and obtain certification by an independent testing laboratory to ensure weld compliance and corner integrity.

b. Test and certify test results per AAMA 503, ASTM E 1105, ASTM E 783, ASTM E 331, and make available upon request.

1.3.2.1 Uniform Load

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. Apply a static air design load of (<MET>3.11 kilopascal for</MET> 85 psf (65 psf for 9/16 inch laminated infill) in the positive and negative direction in accordance with AAMA 501, and ASTM E 330.

b. No deflections are allowed to exceed l/180 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage is allowed.

1.3.2.2 Impact Resistance

Submit certified test reports showing compliance with specified performance characteristics as follows:

Large Missile, tested in accordance with ASTM E 1886 at a door opening of 7 foot - 0 inch by 8 foot - 0 inch.

1.3.2.3 Forced Entry

Submit certified test reports showing compliance with specified performance characteristics as follows:

Test in accordance with ASTM F 1642

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Sample Warranty;

Listing of Product Installations;

SD-02 Shop Drawings

Installation Drawings;

SD-03 Product Data

Manufacturer's Catalog Data

SD-04 Samples

Finish and Color Samples;

SD-06 Test Reports

Certified Test Reports;

SD-07 Certificates

Manufacturer's Product Warranty;

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Installer Qualifications

Provide documentation of Installer experience to perform work of this section, who has specialized in the installation of work similar to that required for this project, and who is acceptable to product manufacturer.

1.5.1.2 Manufacturer Qualifications

Ensure manufacturer is capable of providing field service representation during construction, approving acceptable installer and approving application method.

1.5.2 Pre-Installation Meetings

Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.5.3 Single Source Responsibility

Provide design, structural engineering, and custom fabrication for door portal system and supply of all components, materials, and products based on a single manufacturer of sole responsibility. Provision of products from numerous sources for site assembly without complete single source design and supply responsibility is not acceptable. Work items and components to be fabricated or supplied by single source are:

a. Door assemblies.

b. Glazed wall to be constructed around door portal as specified in this Section.

c. Door operating hardware to be installed on or within door portal as specified in Section 08 71 00 DOOR HARDWARE.

d. Glass as specified in Section 08 81 00 GLAZING.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Ordering

Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

1.6.2 Packing, Shipping, Handling and Unloading

Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.6.3 Storage and Protection

Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

1.7 PROJECT CONDITIONS/ SITE CONDITIONS

1.7.1 Field Measurements

Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication scheduled with construction progress to avoid construction delays.

1.8 DESIGN AND PERFORMANCE CRITERIA

Design, size components, and install door portal system to withstand these loads without breakage, loss, failure of seals, product deterioration, and other defects.

a. Dead and Live Loads: Determined by ASCE 7-10 and calculated in accordance with applicable codes.

b. Seismic loads: Design and install system to comply with applicable seismic requirements for project location as defined by Section 1613 of the International Building Code (IBC).

c. Effects of applicable wind load acting inward and outward normal to plane of wall in accordance with ASTM E 330.

d. Thermal loads and movement:

(1) Ambient temperature range: 120 degrees F.

(2) Material surfaces range: 180 degrees F.

e. Provide and install weatherstripping, exterior gaskets, sealants, and other accessories to resist water and air penetration.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum (Entrances and Components)

2.1.1.1 Material Standard

ASTM B221 ASTM B221M; 6063-T5 alloy and tempered

Provide door stile and rail face dimensions of the entrance doors as follows:

Vertical Stile	Top Rail	Bottom Rail
3-1/2 inches	3-1/2 inches	6-1/2 inches

Provide major portions of the door members at.125 inches nominal in thickness and glazing molding to be .050 inches thick.

2.1.1.2 Tolerances

Reference to tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by The Aluminum Association.

Provide either EPDM elastomeric extrusions or thermoplastic elastomer glazing gaskets. Structural silicone sealant is required.

2.2 MANUFACTURERS

Manufacturers are acceptable providing they meet the requirements specified in this section and project drawings.

2.3 ACCESSORIES

2.3.1 Fasteners

Provide stainless steel where exposed.

2.3.2 Perimeter Anchors

When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

2.3.3 Standard Entrance Hardware

2.3.3.1 Weatherstripping

Equip meeting stiles on pairs of doors with an adjustable astragal utilizing wool pile with polymeric fin.

Provide door weatherstripping on a single acting offset pivot or butt hung door and frame (single or pairs) comprised of a thermoplastic elastomer weatherstripping on a tubular shape with a semi-rigid polymeric backing.

Provide Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Provide as necessary to meet specified performance tests.)

2.3.3.2 Threshold

Provide extruded aluminum threshold, one piece per door opening, with ribbed surface.

2.3.3.3 Offset Pivots

Provide manufacturer's standard top and bottom pivots with one intermediate offset pivot.

2.3.3.4 Panic Device

Provide manufacturer's recommended standard panic hardware.

2.3.3.5 Closer

Provide surface closer only per ANSI/BHMA A156.4.

2.3.3.6 Security Lock/Dead Lock

Provide A/R MS 1850A lock with (2) A/R 1871 cylinder operated flush bolts.

2.3.3.7 Cylinder(s)/Thumb-turn

Provide manufacturer's recommended standard.

2.3.3.8 Cylinder Guard

Manufacturer standard.

2.4 RELATED MATERIALS

2.4.1 Sealants

Refer to Section 07 92 00 JOINT SEALANTS. Ensure all sealants conform to AAMA 800.

2.4.2 Glass

Refer to Section 08 81 00 GLAZING.

2.5 FABRICATION

2.5.1 Entrance System Fabrication

Provide door corner construction consisting of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Provide hook-in type exterior glazing stop with EPDM glazing gaskets reinforced with non-stretchable cord. Provide interior glazing stop mechanically fastened to the door member incorporating a silicone compatible spacer used with silicone sealant.

Accurately fit and secure joints and corners. Make joints hairline in appearance. Prepare components with internal reinforcement for door hardware. Arrange fasteners and attachments to conceal from view.

2.5.2 Shop Assembly

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

2.5.2.1 Welding

Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.5.3 Fabrication Tolerance

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances.

2.5.3.1 Material Cuts

Square to 1/32 inch off square, over largest dimension; proportionate amount of 1/32 inch on the two dimensions.

2.5.3.2 Maximum Offset

1/64 inch in alignment between two consecutive members in line, end to end.

2.5.3.3 Maximum Offset

1/64 inch between framing members at glazing pocket corners.

2.5.3.4 Joints

(Between adjacent members in same assembly: Hairline and square to adjacent member.

2.5.3.5 Variation

In squaring diagonals for doors and fabricated assemblies: 1/16 inch.

2.5.3.6 Flatness

For doors and fabricated assemblies: plus/minus 1/16 inch of neutral plane.

2.6 SOURCE QUALITY CONTROL

2.6.1 Source Quality

Provide aluminum entrances specified herein from a single source.

2.6.1.1 Building Enclosure System

When aluminum entrances are part of a building enclosure system, including storefront framing, windows, curtain wall system and related products, provide building enclosure system products from a single source manufacturer.

2.6.2 Fabrication Tolerances

Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Site Verification of Conditions

Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer's acceptable tolerances.

3.1.2 Field Measurements

Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.2 INSTALLATION

Install entrance system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten system to building structure. Align assembly

plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

Set thresholds in bed of mastic and secure. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylatron pads or bituminous coating. Shim and brace aluminum system before anchoring to structure. Verify weep holes are open, and metal joints are sealed in accordance with manufacturer's installation instructions. Seal metal to metal joints using sealant recommended by system manufacturer.

3.2.1 Preparation

Field verify dimensions prior to fabricating door portal assembly components.

Coordinate requirements for locations of blockouts for anchorage of door portal columns and other embedded components with Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

Coordinate erection of door portal with installation of surrounding glass wall and door assemblies. Ensure adequate provision is made for support and anchorage of assembly components.

Coordinate electrical requirements for electrified door hardware to ensure proper power source, conduit, wiring, and boxes.

3.2.1.1 Adjacent Surfaces Protection

Protect adjacent work areas and finish surfaces from damage during product installation.

3.2.1.2 Aluminum Surface Protection

Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.2.2 Adjusting

Adjust operating hardware for smooth operation, and as recommended by the manufacturer.

3.2.3 Related Products Installation Requirements

3.2.3.1 Sealants (Perimeter)

Refer to Section 07 92 00 JOINT SEALANTS.

3.2.3.2 Glass

Refer to Section 08 81 00 GLAZING.

3.2.3.3 Reference

ANSI Z97.1, 16 CFR 1201 and GANA Glazing Manual.

3.3 PROTECTION AND CLEANING

3.3.1 Protection

Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

3.3.2 Cleaning

Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.4 WARRANTY

Submit three signed copies of manufacturer's product warranty for entrance system as follows:

Warranty Period: Two years from Date of Substantial Completion of the project, provided that the Limited Warranty begins in no event later than six months from date of shipment by manufacturer. In addition, support welded door corner construction with a limited lifetime warranty for the life of the door under normal use.

Ensure Warranty language is identical to "As Approved" version of the sample warranty submitted and returned from the Contracting Officer.

-- End of Section --

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1302.5	(1976) Voluntary Specifications for Forced-Entry Resistant Aluminum Prime Windows
AAMA 1503	(2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
AAMA 611	(1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum
AAMA/WDMA/CSA 101/I.S.2/A440	(2008; Update 1 2008; Update 2 2008; Update 3 2009) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

ASTM INTERNATIONAL (ASTM)

ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM E 1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

GREEN SEAL (GS)

GS-36	(2000) Commercial Adhesives

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2010) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

1.2 CERTIFICATION

Each prime window unit must bear the AAMA Label warranting that the product complies with AAMA/WDMA/CSA 101/I.S.2/A440. Certified test reports attesting that the prime window units meet the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows;

Fabrication Drawings

SD-03 Product Data

Windows;

Hardware;

Fasteners;

Window performance;

Thermal-Barrier Windows;

Mullions;

SD-04 Samples

Finish Sample;

Window Sample;

SD-05 Design Data

Structural calculations for deflection;

Design Analysis;

Submit design analysis with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the minimum antiterrorism standards required by paragraph "Minimum Antiterrorism Performance", unless conformance is demonstrated by Standard Airblast Test results. Calculations verifying the structural performance of each window proposed for use, under the given loads, shall be prepared and signed by a registered Professional Engineer. The window components and anchorage devices to the structure, as determined by the design analysis, shall be reflected in the shop drawings.

SD-06 Test Reports

Minimum condensation resistance factor

Resistance to forced entry

Standard Airblast Test; G

For Minimum hurricane resistant windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shocktube, shall be included in a test report, providing information in accordance with ASTM F 1642, as prepared by the independent testing agency performing the test. The test results shall demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph "Standard Airblast Test Method".

SD-10 Operation and Maintenance Data

Windows.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, stools, casings, sills, trim, installation details, and other related items.

1.4.2 Sample Requirements

1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

1.4.2.2 Window Sample Requirements

Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

1.4.3 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements. A registered Professional Engineer must provide calculations.

Submit design analysis with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the requirements. Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

1.4.4 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, and minimum condensation resistance factor (CRF), and resistance to forced entry.

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which calking and glazing compounds must adhere.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.8 FIELD MEASUREMENTS

Take field measurements prior to preparation of the drawings and fabrication.

1.9 PERFORMANCE REQUIREMENTS

1.9.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least 50 pounds per square foot (psf).

1.9.2 Tests

Test windows proposed for use in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

1.10 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

1.11 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.11.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

1.11.2 Air Infiltration

Air infiltration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.3 Water Penetration

Water penetration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.4 Thermal Performance

Non-residential aluminum windows (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of 0.25 determined according to NFRC 200 procedures and a U-factor maximum of 0.65 Btu/hr-ft^2-F in accordance with NFRC 100.

1.12 QUALIFICATION

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 10 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.13 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

Provide prime windows that comply with AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. In addition to compliance with AAMA/WDMA/CSA 101/I.S.2/A440, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds L/175 of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 42 when tested in accordance with AAMA 1503.

2.1.1 Fixed Windows (F)

Type F-R15.

2.1.2 Forced Entry Resistant Windows

In addition to meeting the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, windows designated for resistance to forced entry must conform to the requirements of AAMA 1302.5.

2.1.3 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

2.1.4 Calking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

2.1.5 Weatherstripping

AAMA/WDMA/CSA 101/I.S.2/A440.

2.2 FABRICATION

Fabrication of window units must comply with AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown.

2.2.2 Weatherstripping

Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) compression-type weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do no use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.

2.2.3 Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

2.2.4 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials, GS-36, SCAQMD Rule 1168, and as specified in Section 07 92 00 JOINT SEALANTS.

2.2.5 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

2.2.6 Combination Windows

Windows used in combination must be the same class and grade and will be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.7 Mullions and Transom Bars

Provide mullions between multiple window units to resist two times (2X) glazing resistance in accordance with ASTM F 2248 and ASTM E 1300. Provide mullions with a thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

2.2.8 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete

installation and proper operation. Furnish extruded aluminum subframe receptors and subsill with each window unit.

2.2.8.1 Hardware

AAMA/WDMA/CSA 101/I.S.2/A440. The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.8.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

2.2.9 Finishes

Exposed aluminum surfaces must be factory finished with an anodic coating. Color must be clear. All windows will have the same finish.

2.2.9.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

b. Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A41, clear (natural) anodized.

2.3 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

a. Aluminum alloy must be 6063-T6.

b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors will not bridge the connection between the inner and outer frame.

2.4 MULLIONS

Provide mullions between multiple-window units where indicated.

Mullions and mullion covers must be the profile indicated, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or

pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members shall be fabricated of the materials specified in AAMA/WDMA/CSA 101/I.S.2/A440 and meet the specified design loading.

PART 3 TITLE

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to AAMA/WDMA/CSA 101/I.S.2/A440. Do not coat surfaces in contact with sealants after installation with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM F 883	(2009) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2006) Butts and Hinges
ANSI/BHMA A156.13	(2005) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.15	(2006) Release Devices Closer Holder, Electromagnetic and Electromechanical
ANSI/BHMA A156.16	(2008) Auxiliary Hardware
ANSI/BHMA A156.18	(2006) Materials and Finishes
ANSI/BHMA A156.21	(2009) Thresholds
ANSI/BHMA A156.22	(2005) Door Gasketing and Edge Seal Systems
ANSI/BHMA A156.3	(2008) Exit Devices
ANSI/BHMA A156.4	(2008) Door Controls - Closers
ANSI/BHMA A156.5	(2010) Auxiliary Locks and Associated Products
ANSI/BHMA A156.6	(2010) Architectural Door Trim
ANSI/BHMA A156.7	(2003; R 2009) Template Hinge Dimensions
ANSI/BHMA A156.8	(2010) Door Controls - Overhead Stops and Holders

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2012) Life Safety Code

NFPA 80 (2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2011) Building Materials Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hardware schedule;

Keying system;

SD-03 Product Data

Hardware items;

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule items,

Submit data package in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Key Bitting

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designation

1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys (AA1, AA2, etc.).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, pivots, and closers of one lock, hinge, pivot, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.5.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware subcontractor, using Activity and Base Locksmith shall meet to discuss key requirements for the facility.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Provide hardware to be applied to metal or to prefinished doors manufactured to template. Promptly furnish template information or templates to door and frame manufacturers. Conform to ANSI/BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements indicated, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Provide the label of Underwriters Laboratories, Inc. for such hardware listed in UL Bld Mat Dir or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the

identifying mark will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

ANSI/BHMA A156.1, 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

2.3.2 Pivots

ANSI/BHMA A156.4.

2.3.3 Locks and Latches

2.3.3.1 Mortise Locks and Latches

ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Install knobs and roses of mortise locks with screwless shanks and no exposed screws.

2.3.4 Exit Devices

ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide touch bars in lieu of conventional crossbars and arms. Provide escutcheons, not less than 7 by 2-1/4 inch.

2.3.5 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Provide cylinders and cores with seven pin tumblers. Provide cylinders from products of one manufacturer, and provide cores from the products of one manufacturer. Mortise cylinders have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core. Provide cylinders for new locks, including locks provided under other sections of this specification. Provide fully compatible cylinders with products of the Best Lock Corporation with interchangeable cores which are removable by a special control key. Factory set the cores with seven pin tumblers using the A4 system and F keyway. Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores.

2.3.6 Keying System

The Government will provide permanent cylinders with cores and keys for mortise locksets, auxiliary locks, and exit devices. Furnish cylinders as manufactured by Best Lock Corp., Arrow Lock Corp., or Falcon Lock. Coordinate delivery schedule with FLETC Lock and Key Department and the COR. Provide temporary cores and keys for the Contractor's use during construction, and for testing the locksets.

2.3.7 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.3.7.1 Lever Handles

Provide lever handles in lieu of knobs where indicated in paragraph entitled "Hardware Schedule". Conform to the minimum requirements of ANSI/BHMA A156.13 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

2.3.7.2 Texture

Provide knurled or abrasive coated knobs or lever handles where specified in paragraph entitled "Hardware Schedule".

2.3.8 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room number on keys.

Furnish seven change keys for each interchangeable core, furnish two control keys, six masters keys, and six construction master keys. Furnish a quantity of key blanks equal to 20 percent of the total number of change keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room numbers on keys.

2.3.9 Door Bolts

ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: ANSI/BHMA A156.3, Type 25.

2.3.10 Closers

ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, except at storefront mounting, pivots, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

2.3.10.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.3.11 Overhead Holders

ANSI/BHMA A156.8.

2.3.12 Closer Holder-Release Devices

ANSI/BHMA A156.15.

2.3.13 Door Protection Plates

ANSI/BHMA A156.6.

2.3.13.1 Sizes of Armor Mop and Kick Plates

2 inch less than door width for single doors; one inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors. Provide a minimum 36 inch armor plates for flush doors, except 16 inch high armor plates on fire doors.Provide 6 inch mop plates.

2.3.14 Door Stops and Silencers

ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.15 Padlocks

ASTM F 883.

2.3.16 Thresholds

ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.17 Weather Stripping Gasketing

ANSI/BHMA A156.22. Provide the type and function designation where specified in paragraph entitled "Hardware Schedule". Provide a set to include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors not to exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Provide weather stripping with one of the following:

2.3.17.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

2.3.17.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

2.3.17.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

2.3.18 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant and fasten with stainless steel screws.

2.3.18.1 Door Rain Drips

Approximately 1-1/2 inch high by 5/8 inch projection. Align bottom with bottom edge of door.

2.3.18.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

2.3.19 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Provide stainless steel or nonferrous metal fasteners that are exposed to weather. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISHES

ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint finish for surface door closers, and except BHMA 652 finish (satin chromium plated) for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

2.6 KEY CABINET AND CONTROL SYSTEM

ANSI/BHMA A156.5, Type E8351 (150 hooks).

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping to prevent damage. Provide full contact, weather-tight seals. Operate doors without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 9 inch on center after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door 1 inch on center and to heads and jambs at 4 inch on center

3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 1-1/2 inch on center.

3.1.2 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

3.3 HARDWARE LOCATIONS

SDI/DOOR A250.8, unless indicated or specified otherwise.

a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.

b. Mop Plates: Bottom flush with bottom of door.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct,

repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

Provide hardware for aluminum doors under this section. Deliver Hardware templates and hardware, except field-applied hardware to the aluminum door and frame manufacturer for use in fabricating the doors and frames.

Below are examples of some typical hardware sets. Each task order will identify hardware set requirements:

HW-1 (EXTERIOR ENTRY)

PIVOTS		--	BY DOOR MFG.
1 EXIT DEVICE	PANELINE, CONCEALED ROD	--	KAWNEER
1 PULL	12" PULL	--	BY DOOR MFG.
1 CYLINDERS	1E74-C4	612	BEST
1 CLOSER	CONCEALED, OVERHEAD	--	BY DOOR MFG.
1 THRESHOLD	2005AT	--	PEMKO
1 DOOR SWEEP	90137CNB	--	PEMKO
1 SET WEATHERSTRIPING		--	BY DOOR MFG.

HW-2 (EXTERIOR ENTRY - PAIR)

PIVOTS		--	BY DOOR MFG.
2 PULL	12" PULL	--	BY DOOR MFG.
1 CYLINDERS	1E74-C4	612	BEST
2 CLOSER	CONCEALED, OVERHEAD	--	BY DOOR MFG.
2 THRESHOLD	2005AT	--	PEMKO
2 DOOR SWEEP	90137CNB	--	PEMKO
2 SET WEATHERSTRIPING		--	BY DOOR MFG.
1 COMBINATION FLUSH BOLT SET		--	BY DOOR MFG.

HW-3 (CORRIDOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 CLOSER	351-O	626 SARGENT
1 STOP	409 OR 440	626 ROCKWOOD
3 SILENCERS	608	GRAY ROCKWOOD

HW-4 (ROOM 109 SERVICE COUNTER)

3 EACH DOUBLE ACTION HINGES	4-1/2 x 4-1/2	626 HAGAR
2 PUSH PLATES	12 INCH PUSH PLATE	626 ROCKWOOD
1 STOP	409 OR 440	626 ROCKWOOD
1 CYLINDER	1E74-C4	612 BEST

HW-5 (DRESSING ROOMS)

3 EACH HINGES	ECBB1101 4-1/2 BY 4-1/2	626 HAGAR
1 LOCKSET PRIVACY	45H7R14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 OR 440	626 ROCKWOOD

3 SILENCERS	608	GRAY ROCKWOOD

HW-6 (INTERIOR CONFERENCE ROOM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7R14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-7 (INTERIOR OFFICE)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7AT14J	626 BEST
1 COAT HOOK (off. side)	790	626 ROCKWOOD
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-8 (INTERIOR DOUBLE DOORS)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
2 CLOSERS	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD

HW-9 (EXTERIOR SECURE ELEC.)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD
1 HEAD DRIP		PEMKO
1 SET WEATHERSTRIPPING		PEMKO
1 DOOR SWEEP	90137CNB	PEMKO

CARD READER TO BE INSTALLED BY OTHERS

HW-10 (INTERIOR SECURE COMM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

CARD READER TO BE INSTALLED BY OTHERS

HW-11 (INTERIOR STORAGE)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-12 (MAILROOM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7D14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-13 (EGRESS DOOR - INTERIOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (EGRESS FUNCTION)	45H7D14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-14 (EXTERIOR PAIR)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (STORAGE)	45H7A14J	626 BEST
2 CLOSERS	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD
1 ASTREGAL		626
1 THRESHOLD	2005AT	PEMKO
2 DOOR SWEEP	90137CNB	PEMKO
2 SETS WEATHERSTRIPPING		PEMKO

HW-14A (EXTERIOR PAIR)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
2 EXIT DEVICE	PANELINE, CONCEALED ROD	US28 DOOR-O-MATIC
2 CLOSER	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD
1 ASTREGAL		626
1 THRESHOLD	2005AT	PEMKO
2 DOOR SWEEP	90137CNB	PEMKO
2 SETS WEATHERSTRIPPING		PEMKO

CARD READER TO BE INSTALLED BY OTHERS

HW-15 (EGRESS DOOR - EXTERIOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (EGRESS FUNCTION)	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD
1 HEAD DRIP		PEMKO
1 SET WEATHERSTRIPPING		PEMKO
1 DOOR SWEEP	90137CNB	PEMKO

1 THRESHOLD	2005AT	PEMKO	

HW-16 (TOILET & BREAK ROOMS)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626	HAGAR
1 SET PUSH /PULL	12 INCH PULL, PUSH PLATE	626	ROCKWOOD
1 STOP	409 or 440	626	ROCKWOOD
3 SILENCERS	608	Gray	ROCKWOOD

-- End of Section --

SECTION 08 81 00

GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2009; Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

ASTM INTERNATIONAL (ASTM)

ASTM C1036	(2011) Standard Specification for Flat Glass
ASTM C1048	(2004) Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM C1172	(2009e1) Standard Specification for Laminated Architectural Flat Glass
ASTM C1184	(2005) Standard Specification for Structural Silicone Sealants
ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C864	(2005; R 2011) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D2287	(2011) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D395	(2003; R 2008) Standard Test Methods for Rubber Property - Compression Set
ASTM E119	(2011a) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E2129	(2010) Standard Practice for Data Collection for Sustainability Assessment of Building Products

ASTM E413	(2010) Rating Sound Insulation
ASTM E90	(2009) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual
GANA Standards Manual	(2001) Tempering Division's Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-3001	(1990) Guidelines for Sloped Glazing
IGMA TM-3000	(1997) Glazing Guidelines for Sealed Insulating Glass Units
IGMA TR-1200	(1983) Commercial Insulating Glass Dimensional Tolerances

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2010) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

SD-03 Product Data

Insulating Glass

Documentation for Energy Star qualifications.

Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Samples

Insulating Glass;

Sealant;

Two 8 by 10 inch samples of each of the following: tinted glass, patterned glass, heat-absorbing glass, and insulating glass units.

Two samples of each indicated material. Samples of plastic sheets shall be minimum 5 by 7 inches.

SD-07 Certificates

Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

SD-08 Manufacturer's Instructions

Setting and sealing materials

Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

SD-11 Closeout Submittals

Insulated Glass Warranty

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in

accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E1300.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.7 WARRANTY

1.7.1 Warranty for Insulating Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

PART 2 PRODUCTS

2.1 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Clear Glass

For interior glazing (i.e., pass and observation windows), 1/4 inch thick glass should be used.

Type I, Class 1 (clear), Quality q4 (A). Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 1/8 inch float glass for openings up to and including 15 square feet, 3/16 inch for glazing openings over 15 square feet but not over 30 square feet, and 1/4 inch for glazing openings over 30 square feet but not over 45 square feet.

2.1.2 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - tinted, Quality q3 - glazing select, 40 percent light transmittance, .67 percent shading coefficient, conforming to ASTM C1036. Color shall be gray.

2.1.3 Laminated Glass

ASTM C1172, Kind LA fabricated from two nominal 1/8 inchpieces of Type I, Class 1, Quality q3, flat annealed transparent glass conforming to ASTM C1036. Flat glass shall be laminated together with a minimum of 0.030 inch thick, clear polyvinyl butyral interlayer. The total thickness shall be nominally 1/4 inch.

2.1.4 Mirrors

2.1.4.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.1.5 Tempered Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 2 (tinted heat absorbing), Quality q3, 1/4 inch thick, 40 percent light transmittance, .67 percent shading coefficient conforming to ASTM C1048 and GANA Standards Manual. Color shall be gray.

2.1.6 Fire/Safety Rated Glass

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass shall have a 45 minute rating when tested in accordance with ASTM E119. Glass shall be permanently labeled with appropriate markings.

2.2 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated 1/2 inch airspace, filled with argon gas, and hermetically sealed. Non-residential glazed systems (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of .35 determined according to NFRC 200 procedures and a U-factor maximum of .70 Btu/hr-ft2-F in accordance with NFRC 100. Glazing shall meet or exceed a luminous efficacy of 1.0.Glazed panels shall be rated for not less than 30 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

Two panes of glass separated by a dehydrated airspace and hermetically sealed. Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

2.2.1 Buildings

Two panes of glass separated by a dehydrated airspace, filled with argon gas and hermetically sealed.

Insulated glass units shall have a Solar Heat Gain Coefficient (SHGC) maximum of .35 and a U-factor maximum of .70 Btu per square foot by hr by degree F.

Glazing shall meet or exceed a luminous efficacy of 1.0. Glazed panels shall be rated for not less than 30 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

The inner light shall be ASTM C1172, clear annealed flat glass Type I, Class I, Quality q3, 1/4 inch thick. The outer light shall be ASTM C1172, Type I, Class 1, Quality q3, 1/8 inch thick, flat glass laminated together with 0.030 inch thick clear PVB interlayer, total thickness shall be 1/4 inch.

2.2.2 Low Emissivity Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 2-tinted with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C1036. Glass performance shall be U value maximum of .70 Btu/hr-ft2-F, Solar Heat Gain Coefficient (SHGC) maximum of.35. Color shall be gray.

2.3 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, IGMA TM-3000, IGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.

2.3.1 Putty and Glazing Compound

Glazing compound shall be as recommended by manufacturer for face-glazing metal sash. Putty shall be linseed oil type. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.3.2 Glazing Compound

Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

2.3.3 Sealants

Provide elastomeric and structural sealants.

2.3.3.1 Elastomeric Sealant

ASTM C920, Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units. Color of sealant shall be white.

2.3.3.2 Structural Sealant

ASTM C1184, Type S.

2.3.4 Joint Backer

Joint backer shall have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

2.3.5 Preformed Channels

Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.

2.3.6 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with ASTM D2287. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

2.3.7 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks shall be dense extruded type conforming to ASTM C509 and ASTM D395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (plus or minus 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer. Block color shall be black.

2.3.8 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.3.8.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C509, Type 2, Option 1.

2.3.8.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C864, Option 1, Shore A durometer between 65 and 75.

2.3.8.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.3.9 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

2.4 MIRROR ACCESSORIES

2.4.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.4.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 1-1/4 by 1/4 by 1/4 inch continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.4.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

PART 3 EXECUTION

3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work.Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.2.2 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of IGMA TB-3001 and IGMA TM-3000.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass.Upon removal, separate protective materials for reuse or recycling. Glass units which are broken, chipped,

cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

SECTION 08 91 00

METAL WALL LOUVERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2007) Laboratory Methods of Testing Dampers for Rating
AMCA 511	(2010) Certified Ratings Program for Air Control Devices

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611	(1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers;

SD-03 Product Data

Metal Wall Louvers;

SD-04 Samples

Wall louvers;

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.5 COLOR SAMPLES

Colors of finishes for wall louvers and door louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Galvanized Steel Sheet

ASTM A653/A653M, coating designation G90.

2.1.2 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

2.1.3 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

2.1.4 Cold Rolled Steel Sheet

ASTM A1008/A1008M, Class 1, with matte finish. Use for interior louvers only.

2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than 50 pounds per square foot. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. The rating shall

show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.

2.2.2 Formed Metal Louvers

Formed of zinc-coated steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 0.08 inch thick.

2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions where indicated for all louvers more than 5 feet in width at not more than 5 feet on centers. Provide mullions covers on both faces of joints between louvers.

2.2.4 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. For steel louvers, provide 1/2 inch square mesh, 12 or 16 gage zinc-coated steel; 1/2 inch square mesh, 16 gage copper; or 1/4 inch square mesh, 16 gage zinc-coated steel or copper bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be clear.

2.4.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish shall be:

a. Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A41, clear (natural) anodized.

2.4.2 Steel

Provide factory-applied coating. Clean and phosphate treat exposed surfaces and apply rust-inhibitive primer and baked enamel finish coat, one mil minimum total dry film thickness, color as selected.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Door Louvers

Install louvers in wood doors by using metal "Z" or "L" moldings. Fasten moldings to door with screws.

3.1.3 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.2 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

-- End of Section --

SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A463/A463M	(2010) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C645	(2011) Nonstructural Steel Framing Members
ASTM C754	(2011) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C841	(2003; R 2008e1) Installation of Interior Lathing and Furring
ASTM C847	(2010a) Standard Specification for Metal Lath

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM EMLA 920	(2009) Guide Specifications for Metal Lathing and Furring

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating. Provide support systems and attachments per UFC 3-310-04, "Seismic Design for Buildings" in seismic zones.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, and ASTM C847.

2.1.1.2 Non-loadbearing Wall Framing

NAAMM EMLA 920.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C645.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C645, but not thinner than 0.0179 inch thickness, with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork, equipment and fixtures, 0.0329 inch thickness. The ASTM certified third party testing statement for equivalent thicknesses shall not apply.

2.1.2.3 Furring Structural Steel Columns

ASTM C645. Steel (furring) clips and support angles listed in UL Fire Resistance may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

2.1.2.4 Z-Furring Channels with Wall Insulation

Not lighter than 26 gage galvanized steel, Z-shaped, with 1-1/4 inch and 3/4 inch flanges and depth as required by the insulation thickness provided.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Lath

3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, except as indicated otherwise.

3.1.1.2 Non-loadbearing Wall Framing

NAAMM EMLA 920, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C754, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2.2 Non-loadbearing Wall Framing and Furring

ASTM C754, except as indicated otherwise.

3.1.2.3 Furring Structural Steel Columns

Install studs or galvanized steel clips and support angles for erection of gypsum wallboard around structural steel columns in accordance with the UL Fire Resistance, design number(s) indicated.

3.1.2.4 Z-Furring Channels with Wall Insulation

Install Z-furring channels vertically spaced not more than 24 inches o.c. Locate Z-furring channels at interior and exterior corners in accordance with manufacturer's printed erection instructions. Fasten furring channels to masonry walls with powder-driven fasteners or hardened concrete steel nails through narrow flange of channel. Space fasteners not more than 24 inches o.c.

3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/4 inch in 8 feet from a straight line;

c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/8 inch in 8 feet from a straight line;

c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11	(1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM C1002	(2007) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C1047	(2010a) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
ASTM C1396/C1396M	(2011) Standard Specification for Gypsum Board
ASTM C475/C475M	(2002; R 2007) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C514	(2004; R 2009e1) Standard Specification for Nails for the Application of Gypsum Board
ASTM C840	(2008) Application and Finishing of Gypsum Board
ASTM C954	(2010) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

GYPSUM ASSOCIATION (GA)

GA 214	(2007) Recommended Levels of Gypsum Board Finish
GA 216	(2010) Application and Finishing of Gypsum Panel Products
GA 224	(2008) Installation of Predecorated Gypsum Board
GA 253	(2007) Application of Gypsum Sheathing
GA 600	(2009) Fire Resistance Design Manual

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cementitious backer units

Water-Resistant Gypsum Backing Board

Accessories

Submit for each type of gypsum board and for cementitious backer units.

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.4.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range. Gypsum wallboard shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.4.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Temperature

Maintain a uniform temperature of not less than 50 degrees F in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives.

1.5.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

1.5.3 Temporary Ventilation

Provide temporary ventilation for work of this section.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.7 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of 5 years of documented successful experience.

1.8 SCHEDULING

The gypsum wallboard shall be taped, spackled and primed before the installation of the highly-emitting materials.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.Submit Material Safety Data Sheets and manufacturer maintenance instructionsfor gypsum materials including adhesives.

2.1.1 Gypsum Board

ASTM C1396/C1396M. Gypsum board shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. Paper facings shall contain 100 percent post-consumer recycled paper content. Gypsum cores shall contain a minimum of 95 percent post-industrial recycled gypsum content.See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Gypsum board may contain post-consumer or post-industrial recycled content.

2.1.1.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.1.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2 Gypsum Backing Board

ASTM C1396/C1396M, gypsum backing board shall be used as a base in a multilayer system.

2.1.2.1 Regular

48 inch wide, 5/8 inch thick, square edges.

2.1.3 Regular Water-Resistant Gypsum Backing Board

ASTM C1396/C1396M

2.1.3.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.3.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.4 Cementitious Backer Units

In accordance with the Tile Council of America (TCA) Handbook.

2.1.5 Joint Treatment Materials

ASTM C475/C475M. Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds shall be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

2.1.5.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.5.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.5.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.5.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.5.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.6 Fasteners

2.1.6.1 Nails

ASTM C514.

2.1.6.2 Screws

ASTM C1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

2.1.6.3 Staples

No. 16 USS gageflattened galvanized wire staples with 7/16 inch wide crown outside measurement and divergent point for base ply of two-ply gypsum board application. Use as follows:

Length of Legs	Thickness of Gypsum Board
28.6 mm 1-1/8 inches	12.7 mm 1/2 inch
31.8 mm 1-1/4 inches	15.9 mm 5/8 inch

2.1.7 Adhesives

Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene. Adhesive must meet the requirements of LEED low emitting materials credit.

2.1.7.1 Adhesive for Fastening Gypsum Board to Metal Framing

Not permitted.

2.1.7.2 Adhesive for Laminating

Not permitted. Adhesive attachment is not permitted for multi-layer gypsum boards.

2.1.8 Gypsum Studs

Provide one inch minimum thickness and 6 inch minimum width. Studs may be of one inch thick gypsum board or multilayers fastened to required thickness. Conform to ASTM C1396/C1396M for material.

2.1.9 Accessories

ASTM C1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges shall be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.10 Asphalt Impregnated Building Felt

Provide a 15 lb asphalt moisture barrier over gypsum sheathing. Conforming to ASTM D 226/D 226M Type 1 (No. 15) for asphalt impregnated building felt.

2.1.11 Water

Provide clean, fresh, and potable water.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Gypsum Board and Framing

Verify that surfaces of gypsum board and framing to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.1.3 Masonry Walls

Verify that surfaces of masonry walls to receive gypsum board applied with adhesive are dry, free of dust, oil, form release agents, protrusions and

voids, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C840 or GA 216 and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may not be bonded together with an adhesive. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Minimize framing by floating corners with single studs and drywall clips. Install 5/8 inch gypsum or ceiling board over framing at 24 inches on center. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System I or GA 216.

3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System II or GA 216.

3.2.3 Adhesive Nail-On Application to Wood Framing

Apply in accordance with ASTM C840, System III or GA 216. This method may be used in lieu of ASTM C840, System I at the option of the Contractor.

3.2.4 Semi-Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System IV or GA 216.

3.2.5 Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System V or GA 216.

3.2.6 Adhesive Application to Interior Masonry or Concrete Walls

Apply in accordance with ASTM C840, System VI or GA 216.

3.2.7 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C840, System VIII or GA 216.

3.2.8 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C840, System IX or GA 216.

3.2.9 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply glass mat water-resistant gypsum tile backing board or water-resistant gypsum backing board in accordance with ASTM C840, System X or GA 216.

3.2.10 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with ASTM C840, System XI or GA 216.

3.2.11 Glass Mat Covered or Fiber Reinforced Gypsum Sheathing

Apply gypsum sheathing in accordance to gypsum association publications GA 253. Follow gypsum sheathing manufacturer's requirements of design details for joints and fasteners and be properly installed to protect the substrate from moisture intrusion. Do not leave exposed surfaces of the gypsum sheathing beyond the manufacturer's recommendation without a weather barrier cladding. Provide continuous asphalt impregnated building felt over sheathing surface in shingle fashion with edges and ends lapped a minimum of 6 inch. Property flash the openings. Seal all joints, seams, and penetrations with a compatible silicone sealant.

3.2.12 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C840, System XIII or GA 216. Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

3.2.13 Application of Foil-Backed Gypsum Board

Apply foil-backed gypsum board in accordance with ASTM C840, System XIV or GA 216.

3.2.14 Application of Predecorated Gypsum Board

Apply predecorated gypsum board in accordance with GA 224. Attach predecorated gypsum board with adhesive and fasteners as recommended by the manufacturer. Conceal fasteners in the finished work.

3.2.15 Application of Impact Resistant Gypsum Board

Apply in accordance with applicable system of ASTM C840 as specified or GA 216. Follow manufacturers written instructions on how to cut, drill and attach board.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with ANSI A108.11. Place a 15 lb asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 6 inch overlap of sheets laid shingle style.

3.3.2 Joint Treatment

ANSI A108.11.

3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Finish plenum areas above ceilings to Level 1 in accordance with GA 214. Finish water resistant gypsum backing board, ASTM C1396/C1396M, to receive ceramic tile to Level 2 in accordance with GA 214.Finish walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting to Level 3 in accordance with GA 214. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with GA 214.Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall framing in accordance with the specifications contained in UL Fire Resistance for the Design Number(s) indicated, or GA 600 for the File Number(s) indicated. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

-- End of Section --

SECTION 09 30 00

CERAMIC TILE, QUARRY TILE, AND PAVER TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1026	(2010) Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C1027	(2009) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C1028	(2007e1) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C144	(2011) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C206	(2003; R 2009) Standard Specification for Finishing Hydrated Lime
ASTM C207	(2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C241/C241M	(2009) Standard Specification for Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C33/C33M	(2011) Standard Specification for Concrete Aggregates
ASTM C373	(1988; R 2006) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C482	(2002; R 2009) Bond Strength of Ceramic Tile to Portland Cement
ASTM C501	(1984; R 2009) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser

ASTM C648	(2004; R 2009) Breaking Strength of Ceramic Tile
ASTM C847	(2010a) Standard Specification for Metal Lath
ASTM D 2103	(2010) Standard Specification for Polyethylene Film and Sheeting
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

GREEN SEAL (GS)

GS-36	(2000) Commercial Adhesives

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual	(2003) Dimension Stone Design Manual

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk	(2010) Handbook for Ceramic Tile Installation

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless

otherwise specifically authorized by manufacturer. For materials like Tile, Accessories, and marble Thresholds submit Samples of sufficient size to show color range, pattern, type and joints.

1.2.2 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Tile;
Setting-Bed;
Mortar, Grout, and Adhesive

SD-04 Samples

Tile;
Accessories;
Marble Thresholds;
Grout;

SD-06 Test Reports

Testing;

SD-07 Certificates

Tile;
Mortar, Grout, and Adhesive;

1.4 QUALITY ASSURANCE

Dimension and draw detail drawings at a minimum scale of 1/4 inch = 1 foot. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit drawings showing ceramic tile pattern elevations and floor plans.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 50 degrees F and rising. Maintain temperature above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.

1.8 EXTRA MATERIALS

Supply an extra five percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 TILE

Conform to TCA Hdbk for standard grade tile. Provide grade sealed containers. Mark seals with the marks on the signed master grade certificate. Provide an impact resistant tile with a minimum floor breaking strength for wall tile of 90 pound and for floor tile of 250 pound in accordance with ASTM C648. The manufacturer will provide a frost resistant rating for tile used in cold climate projects as determined by ASTM C1026. Provide a 0.50 maximum percent water absorption in accordance with ASTM C373. Provide a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C1028. Identify floor tile as Class IV Plus-Extra Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C1027 for abrasion resistance as related to foot traffic. Coordinate the color with Finish Specifications. Tile shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content, unless specified otherwise. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Tile may contain post-consumer or post-industrial recycled content. Submit manufacturer's catalog data and preprinted installation and cleaning instructions plus a master grade certificate for tile. Indicate VOC content.

2.1.1 Porcelain Tile

Furnish an unglazed porcelain tile and trim with the color extending uniformly through the body of the tile. Criteria for tile to meet or exceed is as follows: Abrasive wear in accordance with ASTM C501 and bonding strength in accordance with ASTM C482. Comply with 36 CFR 1191 for coefficient of friction for interior tiled floors. Coordinate color with Room Finish Specifications on drawings.

2.1.2 Glazed Wall Tile

Provide glazed wall tile with cushioned edges and trim edged with lead-free matte finish. Provide tile as noted on Finish Specification on drawings.

2.2 SETTING-BED

Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to ASTM C33/C33M for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to ASTM C150/C150M for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to ASTM C144 for sand.

2.2.4 Hydrated Lime

Conform to ASTM C206 for hydrated lime, Type S or ASTM C207, Type S.

2.2.5 Metal Lath

Conform to ASTM C847 for flat expanded type metal lath, and weighing a minimum 2.5 pound/square yard.

2.3 WATER

Provide potable water.

2.4 MORTAR, GROUT, AND ADHESIVE

Submit certificates indicating conformance with specified requirements. Submit LEED documentation relative to low-emitting materials credit in accordance with LEED Reference Guide. Include in LEED Documentation Notebook. Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of LEED low emitting materials credit. Conform to the following for mortar, grout, adhesive, and sealant:

2.4.1 Dry-Set Portland Cement Mortar

TCA Hdbk. Zero-volatile organic compound (VOC) content.

2.4.2 Ceramic Tile Grout

TCA Hdbk; petroleum-free and plastic-free sand portland cement grout. Maximum VOC content of 150 grams/liter.

2.4.3 Organic Adhesive

TCA Hdbk, Type I. Water-resistant. Comply with applicable regulations regarding toxic and hazardous materials, GS-36, and as specified. Tile adhesive shall have a maximum VOC content of 65 grams/liter.

2.4.4 Epoxy Resin Grout

TCA Hdbk. Prohibited unless specifically indicated otherwise.

2.4.5 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Single-component polyurethane sealant shall have a zero-VOC content.

2.4.6 Cementitious Backer Board

Provide cementitious backer units, for use as tile substrate over wood sub-floors, in accordance with TCA Hdbk. Furnish 1/2inch thick cementitious backer units.

2.5 MARBLE THRESHOLDS

Provide marble thresholds of size required by drawings or conditions. Categorize marble Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble with gray in color as approved by the Contracting Officer. Provide minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M.

2.6 MEMBRANE MATERIALS

Conform to ASTM D 226/D 226M, Type 1 for 15 pound waterproofing membrane, asphalt-saturated building felt. Conform to ASTM D 2103 4 mil for polyethylene film.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of TCA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.
Organic Adhesives	3 mm in 2.4 meter1/8 inch in 8 ft.	1.5 mm in 1 meter1/16 inch in 3 ft.
Latex Portland Cement Mortar	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.
Epoxy	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.

3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for

sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar.

3.3 INSTALLATION OF WALL TILE

Install wall tile in accordance with the TCA Hdbk.

3.3.1 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 4 mil polyethylene membrane, metal lath, and scratch coat. Conform to TCA Hdbk for workable mortar bed, materials, and installation of tile. Conform to TCA Hdbk for cured mortar bed and materials.

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use Latex-Portland Cement to install tile in accordance with TCA Hdbk. Use Latex Portland Cement when installing porcelain ceramic tile.

3.3.3 Organic Adhesive

Conform to TCA Hdbk for the organic adhesive installation of ceramic tile.

3.4 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with TCA Hdbk.

3.4.1 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to TCA Hdbk for workable mortar bed materials and installation. Conform to TCA Hdbk for cured mortar bed materials and installation. Provide minimum 1/4 inch to maximum 3/8 inch joints in uniformed width.

3.4.2 Dry-Set and Latex-Portland Cement

Use Latex-Portland cement mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with TCA Hdbk. Use Latex Portland cement when installing porcelain ceramic tile.

3.4.3 Resinous Grout

When resinous grout is indicated, grout quarry tile with epoxy resin grout. Rake and clean joints to the full depth of the tile and neutralize when recommended by the resin manufacturer. Install epoxy resin grout in conformance with TCA Hdbk. Install resin grout in accordance with manufacturer's printed installation instructions. Provide a coating of wax applied from the manufacturer on all tile installed and furan resin. Follow manufacturer's printed installation instructions of installed resin grout for proportioning, mixing, installing, and curing. Maintain the recommended temperature in the area and on the surface to be grouted. Protect finished grout of grout stain.

3.4.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCA Hdbk.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Install thresholds where indicated, in a manner similar to that of the ceramic tile floor. Provide thresholds full width of the opening. Install head joints at ends not exceeding 1/4 inch in width and grouted full.

3.6 EXPANSION JOINTS

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

3.6.1 Walls

Provide expansion joints at control joints in backing material. Wherever backing material changes, install an expansion joint to separate the different materials.

3.6.2 Floors

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Extend expansion joints through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles.

-- End of Section --

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A489	(2004e1) Standard Specification for Carbon Steel Lifting Eyes
ASTM A580/A580M	(2008) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2007) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635/C635M	(2007) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2010) Latex Sealants
ASTM E 1264	(2008e1) Acoustical Ceiling Products

ASTM E 1414	(2011) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E 1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
ASTM E 580/E 580M	(2011a) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 795	(2005) Mounting Test Specimens During Sound Absorption Tests

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2007; Change 1) Seismic Design for Buildings

1.2 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.2.1 Ceiling Attenuation Class and Test

Provide a ceiling system with an attenuation class (CAC) of 40 - 44 for ACT when determined in accordance with ASTM E 1414. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

1.2.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423 Test Method.

1.2.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings;

SD-03 Product Data

Acoustical Ceiling Systems;

SD-04 Samples

Acoustical Units;
Acoustic Ceiling Tiles;

SD-06 Test Reports

Fire Resistive Ceilings
Ceiling Attenuation Class and Test

1.4 NOT USED

1.5 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.7 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited

to, sagging and warping of panels; rusting and manufacturers defects of grid system.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Submit two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E 1264, Class A, and the following requirements:

2.1.1 Affirmative Procurement

Mineral Wool, Cellulose, and Laminated Paperboard used in acoustic ceiling tiles are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG). EPA's recommended Recovered Materials Content Levels for Mineral Wool, Cellulose, Structural Fiberboard and Laminated Paperboard are:

Product	Material	Percent of Post Consumer Materials	Percent of Total Recovered Materials
Laminate Paperboard	Post Consumer Paper	100	100
Rock Wool	Slag	75	
Cellulose	Post Consumer Paper	75	75

a. The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

2.1.2 Units for Exposed-Grid System A

a. Type: III (non-asbestos mineral fiber with painted finish).

b. Flame Spread: Class A, 25 or less

c. Pattern: A.

d. Minimum NRC: 0.75 in open office areas; 0.60 in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; 0.50 in all other rooms and areas when tested on mounting Type E-400 of ASTM E 795.

e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.

f. Nominal size: 24 by 24 inch.

g. Edge detail: Reveal.

h. Finish: Factory-applied standard finish.

i. Minimum CAC: 40.

2.1.3 Unit Acoustical Absorbers

Absorbers shall be individually mounted sound absorbing plaques composed of glass fibers or non-asbestos mineral fibers and having a NRC range of not less than 0.60 - 0.70 when tested in accordance with ASTM C423 and reported as a 4 frequency average.

2.2 SUSPENSION SYSTEM

Classification	kg/meter (lb/Linear Foot) of Main Runner		
	Direct Hung	Indirect Hung	Furring Bar
Light Duty	7.38 (5.0)	2.95 (2.0)	6.64 (4.5)
Intermediate Duty	17.72 (12.0)	5.17 (3.5)	9.6 (6.5)
Heavy Duty	23.62 (16.0)	11.81 (8.0)	-

Provide standard, exposed-grid, standard width flange as shown on drawings suspension system conforming to ASTM C635/C635M for heavy-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied white baked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide standard or mitered corners. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the guidance in UFC 3-310-04 and ASTM E 580/E 580M.

2.3 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.3.1 Wires

Conform wires to ASTM A641/A641M, Class 1, 0.11 inch in diameter. ASTM A580/A580M, composition 302 or 304, condition annealed stainless steel, 0.11 inch in diameter.

2.3.2 Straps

Provide straps of 1 by 3/16 inch galvanized steel conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008Mwith an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.3.3 Rods

Provide 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

2.3.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Eyebolt size must be a minimum 1/4 inch, zinc coated.

2.3.5 Masonry Anchorage Devices

Comply with ASTM C636/C636M for anchorage devices for eyebolts and machine screws.

2.4 ACCESS PANELS

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 12 by 12 inch or more than 12 by 24 inch.

a. Attach an identification plate of 0.032 inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.

b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 1 inch diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

1 Fire detection/alarm system

2 Air conditioning controls

3 Plumbing system

4 Heating and steam systems

5 Air conditioning duct system

6 Sprinkler system

7 Intercommunication system

11 Program entertainment

12 Telephone junction boxes

2.5 ADHESIVE

Use adhesive as recommended by tile manufacturer.

2.6 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.7 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components as noted on Room Finish Specifications.

2.8 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation.Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

3.4 RECLAMATION PROCEDURES

Neatly stack ceiling tile, designated for recycling by the Contracting Officer, on 4 by 4 foot pallets not higher than 4 foot. Panels must be completely dry. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4078	(2002; R 2008) Water Emulsion Floor Polish
ASTM E 648	(2010e1) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM F 1066	(2004e1; R 2010) Standard Specification for Vinyl Composition Floor Tile
ASTM F 1482	(2004; R 2009e1) Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
ASTM F 1861	(2008) Resilient Wall Base
ASTM F 1869	(2011) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F 2170	(2009) Determining Relative Humidity in Concrete Floor Slabs in situ Probes
ASTM F 710	(2011) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Fire Resistance Requirements

Provide a minimum average critical radiant flux of 0.22 watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E 648.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Flooring and Accessories;

SD-03 Product Data

Resilient Flooring and Accessories;
Adhesives;
Vinyl Composition Tile;
Wall Base;

SD-04 Samples

Resilient Flooring and Accessories;

SD-06 Test Reports

Moisture, Alkalinity and Bond Tests;

SD-08 Manufacturer's Instructions

Surface Preparation;
Installation;

SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories;

1.4 NOT USED

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature maintained

above 68 degrees F and below 85 degrees F, stacked according to manufacturer's recommendations. Remove resilient flooring products from packaging to allow ventilation prior to installation. Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store exposed rubber surface materials in occupied spaces. Do not store near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 68 degrees F and below 85 degrees F for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 55 degrees F thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.7 SCHEDULING

Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 VINYL COMPOSITION TILE TYPE A

Conform to ASTM F 1066 Class 2, (through pattern tile), Composition 1, asbestos-free, 12 inch square and 1/8 inch thick. Provide color and pattern uniformly distributed throughout the thickness of the tile. Tile shall contain a minimum of 90 percent recycled material.

2.2 WALL BASE

Conform to ASTM F 1861, Type TS (vulcanized thermoset rubber), Style B (coved - installed with resilient flooring). Provide 4 inch high and a minimum 1/8 inch thick wall base. Provide job formed corners in matching height, shape, and color. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Rubber sheet flooring may contain post-consumer or post-industrial recycled content.

2.3 MOULDING

Provide tapered mouldings of rubber and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide vertical lip on moulding of maximum 1/4 inch. Provide bevel change in level between 1/4 and 1/2 inch with a slope no greater than 1:2.

2.4 ADHESIVES

Provide adhesives for flooring, base and accessories as recommended by the manufacturer and comply with local indoor air quality standards. Interior adhesives shall meet the requirements of LEED low emitting materials credit. VOC content shall be less than 50 grams/L. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Provide Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

2.5 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers as recommended by the flooring manufacturer for the subfloor conditions. Comply with ASTM F 1482 for panel type underlayment products. Use one of the following substrates:

a. Concrete.

2.6 POLISH/FINISH

Provide polish finish as recommended by the manufacturer and conform to ASTM D 4078 for polish.

2.7 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

2.8 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories selected from manufacturer's standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers. Provide floor patterns as specified on the drawings. Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern. Submit scaled drawings indicating patterns (including location of patterns and colors) and dimensions. Submit manufacturer's descriptive data and three samples of each indicated color and type of flooring, base, mouldings, and accessories sized a minimum 2-1/2 by 4 inch. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 3 EXECUTION

3.1 EXAMINATION

Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation. Do not take any corrective action without written permission from the Government.Work will proceed only when conditions have been corrected and accepted by the installer. Submit manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

3.2 SURFACE PREPARATION

Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor to be flat to within 3/16 inch in 10 feet. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Prepare the surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) as recommended by the flooring manufacturer. Comply with ASTM F 710 for concrete subfloor preparation. Floor fills or toppings may be required as recommended by the flooring manufacturer. Install underlayments, when required by the flooring manufacturer, in accordance with manufacturer's recommended printed installation instructions. Comply with ASTM F 1482 for panel type underlayments. Before any work under this section is begun, correct all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces. Repair all damaged portions of concrete slabs as recommended by the flooring manufacturer. Remove concrete curing and sealer compounds from the slabs, other than the type that does not adversely affect adhesion. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.

3.3 MOISTURE, ALKALINITY AND BOND TESTS

Determine the suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing in accordance with ASTM F 1869 or ASTM F 2170, unless otherwise recommended by the flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Submit copy of test reports for moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

3.4 PLACING VINYL COMPOSITION, LINOLEUM AND SOLID VINYL TILES

Install tile flooring and accessories in accordance with manufacturer's printed installation instructions.Prepare and apply adhesives in accordance with manufacturer's directions. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

3.5 PLACING TRANSITION

Provide transition moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. Secure moulding with adhesive as recommended by the manufacturer. Prepare and apply adhesives in accordance with manufacturer's printed directions.

3.6 PLACING WALL BASE

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

3.7 CLEANING

Immediately upon completion of installation of flooring in a room or an area, dry/clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions. No sooner than 5 days after installation, wash flooring with a nonalkaline cleaning solution, rinse thoroughly with clear cold water, and, except for rubber flooring and stair treads, risers and stringers, vinyl and other flooring not requiring polish finish by manufacturer, apply the number of coats of polish in accordance with manufacturer's written instructions. Clean and maintain all other flooring as recommended by the manufacturer.

3.8 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

SECTION 09 68 00

CARPET

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC TM 107	(2009) Colorfastness to Water
AATCC TM 134	(2006; E 2008) Electrostatic Propensity of Carpets
AATCC TM 16	(2004; E 2008) Colorfastness to Light
AATCC TM 165	(2008; E 2009) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method
AATCC TM 174	(2007) Antimicrobial Activity Assessment of Carpets

ASTM INTERNATIONAL (ASTM)

ASTM D 3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D 5793	(2005) Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
ASTM D 5848	(2010e1) Mass Per Unit Area of Pile Yarn Floor Coverings
ASTM D 6859	(2005) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings
ASTM E 648	(2010e1) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2002) Standard for Installation Specification of Commercial Carpet

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1630	Standard for the Surface Flammability of Carpets and Rugs (FF 1-70)
40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Scheduling

Install carpet systems after the installation and ventilation period of materials or finishes which have high short-term emissions of VOCs, formaldehyde, particulates, or other air-borne compounds which may be adsorbed by or settle on the carpet tiles.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Carpet;
Moldings;
Surface Preparation;
Installation;

SD-04 Samples

Carpet;
Moldings;

SD-06 Test Reports

Moisture and Alkalinity Tests;

SD-10 Operation and Maintenance Data

Carpet;
Cleaning and Protection;
Maintenance Service

1.4 QUALITY ASSURANCE

Provide the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label for carpet and adhesives or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet, carpet cushion, and adhesives bearing the label will indicate that the carpet has been tested and meets the Regulatory Requirements and criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Procure carpet in accordance with 40 CFR 247, and where possible, purchased locally to reduce emissions of fossil fuels from transporting. Conform to EPA requirements in accordance RECYCLED / RECOVERED MATERIALS for carpet.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, and maintain at a temperature above 60 degrees F for 2 days prior to installation. Carpet or carpet tiles shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store carpet near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.6 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above 60 degrees F and below 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten (10) year wear warranty, two (2) year material and workmanship and ten (10) year tuft bind and delamination.

PART 2 PRODUCTS

2.1 CARPET

Furnish first quality carpet; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Provide the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) Label. Carpet type bearing the label will indicate that carpet has been tested and meets the criteria of the CRI Green Label Requirements for Indoor Air Quality Test Criteria. Provide carpet tiles with Carpet Component Identification Codes as established by the CRI for future recycling. The labels shall be permanently printed or attached to the carpet backing. The codes shall identify, at minimum, the carpet's

face fiber, primary backing, and secondary backing. Submit certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.
Submit Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's catalog data for the following items:
Carpet Moldings. Submit samples of the following:

a. Carpet: Two "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

b. Vinyl or Aluminum Moldings: Two pieces of each type at least 12 inches long.

c. Special Treatment Materials: Two samples showing system and installation method.

2.1.1 Modular Tile

Carpet shall comply with the following:

a. Carpet Construction: Tufted or Woven, see Finish Specifications on drawings.

b. Type: Modular tile, see Finish Specifications on drawings for sizes.

c. Pile Type: Multilevel loop.

d. Pile Fiber: Commercial 100 percent branded (federally registered trademark) nylon continuous filament.

e. Yarn Ply: Minimum 2.

f. Gauge or Pitch: Minimum 1/2 inch in accordance with ASTM D 5793.

g. Stitches or Rows/Wires: Minimum 8.0 per square inch.

h. Surface Pile Weight: Minimum 24 ounces per square yard. This does not include weight of backings. Determine weight in accordance with ASTM D 5848.

i. Pile Thickness: Minimum 0.120 inch in accordance with ASTM D 6859.

j. Pile Density: Minimum 4500.

k. Dye Method: Solution dyed.

l. Backing Materials: Provide primary backing materials like synthetic material. Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is needed. Carpet backing may contain post-consumer or post-industrial recycled content.

2.2 PERFORMANCE REQUIREMENTS

a. Static Control: Provide static control to permanently regulate static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC TM 134.

b. Flammability and Critical Radiant Flux Requirements: Comply carpet with 16 CFR 1630. Provide carpet in corridors and exits with a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648.

c. Tuft Bind: Provide tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 10 pound average force for loop pile.

d. Colorfastness to Crocking: Comply dry and wet crocking with AATCC TM 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

e. Colorfastness to Light: Comply colorfastness to light with AATCC TM 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

f. Colorfastness to Water: Comply colorfastness to water with AATCC TM 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

g. Delamination Strength: Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs/inch.

h. Antimicrobial: Nontoxic antimicrobial treatment in accordance with AATCC TM 174 Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.

2.3 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers shall comply with applicable regulations regarding toxic and hazardous materials. Use wet adhesive with a maximum VOC content of 50 grams/liter. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation to meet local air-quality standards, and as required by the carpet manufacturer. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 140 degrees F in accordance with ASTM D 3278.

2.4 MOLDINGS

Install carpet moldings, either vinyl or aluminum, where floor covering material changes or carpet edge does not abut a vertical surface. Provide a hammered surface aluminum molding, pinless clamp-down type, designed for the type of carpet being installed. Provide natural color anodized or heavy-duty vinyl molding designed for the type of carpet being installed.

2.5 TAPE

Provide tape for seams as recommended by the carpet manufacturer for the type of seam used in installation. Any seam sealant shall have a maximum

VOC content of 50 grams/liter. Do not use sealants that contain 1,1,1-trichloroethane or toluene.

2.6 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern in accordance with the drawings.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

3.2 MOISTURE AND ALKALINITY TESTS

Test concrete slab for moisture content and excessive alkalinity in accordance with CRI 104. Submit three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the carpeting until concrete substrate is at least 90 days old. Prepare the concrete surfaces in accordance with instructions of the carpet manufacturer. Match carpet, when required, and adhesives to prevent off-gassing to a type of curing compounds, leveling agents, and concrete sealer.

3.4 INSTALLATION

Isolate area of installation from rest of building. Perform all work by installers who are CFI certified (International Certified Floorcovering Installer Association), or manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI 104. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Use autofoam mothproofing system for wool carpets. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Submit three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

3.4.1 Modular Tile Installation

Install modular tiles with permanent vinyl-compatible or release adhesive and snugly jointed together. Lay tiles as noted on drawings with accessibility to the subfloor where required.

3.4.2 Entrance Carpet Installation

Install tiles with permanent vinyl-compatible or release adhesive and shall be snugly jointed together. Lay tiles as shown on drawings.Prepare regular, unnoticeable, and treated seams with a seam adhesive. Install breadths parallel, with carpet pile in the same direction. Match patterns accurately. Neatly cut and fit, securely, cutouts at door jambs, columns, and ducts. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points.

3.5 CLEANING AND PROTECTION

Submit three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

3.5.1 Cleaning

As specified in Section 01 78 00 CLOSEOUT SUBMITTALS. After installation of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean with a high-efficiency particulate air (HEPA) filtration vacuum.

3.5.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover.Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer. Installation of carpet shall occur when all other trades have completed their work just before substantial completion.

3.6 REMNANTS

Remove non-retained scraps from site and recycle appropriately.

-- End of Section --

SECTION 09 72 00

WALL COVERINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 751	(2006) Coated Fabrics
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)

CFFA-W-101-D	(2002) Vinyl Coated Fabric Wallcovering

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

GYPSUM ASSOCIATION (GA)

GA 214	(2007) Recommended Levels of Gypsum Board Finish

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 286	(2011) Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS CCC-W-408	(Rev D; Notice 1) Wallcovering, Vinyl Coated

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wall Coverings and Accessories;
Primer and Adhesive;
Vinyl Wall Covering;

SD-04 Samples

Wall Coverings and Accessories;
Wall Coverings;

SD-08 Manufacturer's Instructions

Wall Coverings and Accessories

SD-10 Operation and Maintenance Data

Vinyl Wall Covering;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver the material to the site in manufacturer's original wrappings and packages and clearly label with the manufacturer's name, brand name, pattern and color name and number, dye lot number, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than 50 degrees F and within a relative humidity range of 30 to 60 percent. Store wall covering material in a flat position and protected from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

1.5 ENVIRONMENTAL REQUIREMENTS

Comply with wall covering manufacturer's printed installation instructions for minimum temperature of area to receive requirements for conditioning adhesive and wall covering. Provide a minimum 50 degrees F area temperature, 72 hours prior to installation, during installation, and until the adhesive dries. Observe ventilation and safety procedures.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period.

PART 2 PRODUCTS

2.1 WALL COVERINGS

Provide Wall coverings and accessories material designed specifically for the specified use. Furnish vinyl wall covering and borders with a mercury, cadmium, lead, and chromium free base. Protect wall coverings with

bactericides and mildew inhibitors against microbiological and mildew growth.

2.1.1 Vinyl Wall Covering

Provide vinyl wall covering with an integrally pigmented, opaque vinyl film, laminated to, or combined with, a fabric backing and submit manufacturer's catalog data. For wall coverings in general, vinyl wall covering, accessories, primer and adhesive submit/provide the following, as applicable:

a. Wall covering manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

b. Primer and Adhesive manufacturer's descriptive data, documentation stating physical characteristics, mildew and germicidal characteristics. Also Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

c. Three samples of each indicated type, pattern, and color of wall covering. Provide minimum 5 by 7 inch samples of wall covering to show pattern repeat of sufficient size.

d. Vinyl Wall Covering Mockup Panels. After vinyl wall covering samples are approved, and prior to starting installation, provide a minimum 8 by 8 foot vinyl wall covering mock-up for each color and type of vinyl wall covering, using the proposed primers and adhesives and actual substrate materials. Once approved, use the mock-up samples as a standard of workmanship for installation within the facility. Written notification to the Contracting Officer at least 48 hours prior to mock-up installation.

e. Wall Covering: Three samples, 3 yards long by the width specified, of each color and grain to be installed in the work, as required to illustrate material weight, color, shade, decorative design, and embossing when required.

f. Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. Date the statement after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified. Certificates for Vinyl Wall Covering including the following:

   (1) Certified laboratory test reports of the physical properties for vinyl wall covering, as specified.

   (2) Certificates of Compliance for UL fire hazard classification listing, as specified.

   (3) Certificates of Compliance for contact adhesive.

g. Preprinted installation instructions for wall covering and accessories, adhesives and primers. Include preparation of the substrate within the instructions.

h. Preventative maintenance and inspection for Vinyl Wall Covering showing the manufacturer's recommended cleaning materials and application methods, including precautions in the use of cleaning materials that may be detrimental to the wall covering surface when improperly applied.

Provide a medium-duty type wall covering, finish as specified, conforming to FS CCC-W-408, Type II, and the following modifications:

Supporting material for wall covering may be mildew-resistant treated at the option of the wall covering manufacturer.

Provide the following physical properties:

REQUIREMENT	TEST METHOD	VALUE
Coating weight, exclusive of fabric backing	CFFA-W-101-D, Test 5041	Not less than 240 gm per square meter 7 ounces per square yard
Adhesion of coating to fabric backing	ASTM D 751	Not less that 13 N 3 pounds pull per 25 mm inch of width

Match color and grain of wall covering of the sample approved. Provide a 53 to 54 inch width wall covering.

2.1.2 Vinyl Wall covering Type A

	Type I	Type II	Type III
ozs/sq yd	7 (10)	13	
ozs/linear yd	10.5 (15)	20	
g/sq meter	237 (339)	441	
g/linear meter	325 (465)	620	

Provide a vinyl coated woven or nonwoven wall covering fabric. Conform to CFFA-W-101-D for vinyl wall covering, Type II (Medium Duty) with a minimum total weight of 13 ounces/square yard and 20 ounces/linear yard. Provide width of 52/54 inch. Test vinyl wall covering in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E 84.

2.2 PRIMER AND ADHESIVE

Provide a type primer and adhesive recommended by the wall covering manufacturer, containing a non-mercury based mildewcide, and complying with local indoor air quality standards. VOC content shall be less than the current VOC content limits of SCAQMD Rule 1168. Primer shall permit removal of the wall covering and protect the wall surface during removal. Do not damage gypsum wallboard facing paper during removal of wall covering. Provide a strippable type adhesive. When substrate color variations show through vinyl wall covering, provide a white pigmented primer as recommended

by the wall covering manufacturer used to conceal the variations. Provide a recommended type adhesive to install corner guards and wainscot cap by the manufacturer of the corner guards and wainscot cap.

2.3 COLOR, TEXTURE, AND PATTERN

Provide color as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 EXAMINATION

Inspect all areas and conditions under which wall coverings are to be installed. Notify the Contracting Officer, in writing, of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Do not apply wall covering to surfaces that are rough, that contain stains which will bleed through the wall covering, or that are otherwise unsuitable for proper installation. Fill cracks and holes; sand rough spots smooth. Finish walls to receive presentation dry erase wall covering to a Level 4 gypsum wallboard finish in accordance with GA 214 unless Level 5 is recommended by the wall covering manufacturer. Thoroughly dry surfaces at least 30 days prior to installation of vinyl wall covering. Provide interior surfaces of new and existing gypsum wallboard with a wall covering primer in accordance with the manufacturer's printed instructions. As required, use white primer when substrate color variations are visible through thin or light color wall covering. Seal interior surfaces of exterior masonry walls to prevent moisture penetration, then prime with a wall covering primer in accordance with the manufacturer's printed instructions. Provide masonry walls with flush joints. Test moisture content of plaster, concrete, and masonry with an electric moisture meter of a maximum five percent reading. Apply a thin coat of joint compound or cement plaster, as recommended by the wall covering manufacturer, to the concrete and masonry walls as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, prime the walls as recommended by the wall lining manufacturer. Prime the surfaces of walls as required by the manufacturer's printed instructions to permit ultimate removal of wall covering from the wall surfaces. Allow primer to completely dry before adhesive application.

3.3 INSTALLATION

3.3.1 Corner Guards and Wainscot Cap

Install corner guards and wainscot cap where shown on drawings and in accordance with the manufacturer's printed instructions. Run corner guards from top of base to ceiling in a continuous length.

3.4 CLEAN-UP

Upon completion of the work, clean wall covering free of dirt, soiling, stain, or residual film. Remove and clean surplus materials, rubbish, and debris resulting from the wall covering installation.

-- End of Section --

SECTION 09 83 13

ACOUSTICAL WALL TREATMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2009; Errata First Printing) International Building Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings;

SD-03 Product Data

Installation Acoustical Wall Panels;

SD-04 Samples

Acoustical Wall Panels;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Protect materials delivered and placed in storage from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 ACOUSTICAL WALL PANELS

Provide acoustical wall panels consisting of prefinished, factory assembled, seamless fabric covered, fiber glass or mineral fiber core system as described below manufactured to the dimensions and configurations shown on the approved detail drawings; submit drawings showing plan locations, elevations and details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials. Perimeter edges shall be reinforced by either an aluminum frame or a formulated resin edge hardener. Acoustical wall panels installed in non-sprinklered areas shall comply with the requirements of ICC IBC, Standard 42-2. Comply with EPA requirements in accordance with RECYCLED / RECOVERED MATERIALS. Submit manufacturer's descriptive data and catalog cuts; wood system with backing, minimum 18 inches wide by 24 inches long 3 samples of each color range specified; and certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance. Wall panels shall conform to the following:

a. Panel Width: Widths shall be nominal 48 inches Panel width shall be as detailed.

b. Panel Height: Heights shall be nominal 24 inches. Panels shall be field measured for custom fit to ceiling.

c. Thickness: Panel thickness shall be as required to meet the indicated NRC range; 3 and 1/8 inch.

d. Panel Construction: Seamless clear lacquer solid bentwood birch profiles, a lacquered solid wood frame and an acoustically rated polyester fiber batting with an anthracite-colored linen cover. Fabric covering shall be stretched free of wrinkles and then bonded to the edges and back or bonded directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer.

e. Fire rating for the complete composite system: Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E 84.

f. Noise Reduction Coefficient (NRC) Range: 0.80-0.90 ASTM C423.

g. Core Type: Acoustically rated polyester finer batting core.

h. Mounting: Acoustical panels shall be mounted by manufacturer's standard keyholes. Provide blocking in wall at all keyhole mounting sites. Install panels per manufacturer instructions. Coordinate keyhole locations to mount directly to studs. Panels to be installed horizontally.

2.2 COLOR

Color shall be as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Walls shall be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Do not begin installation until all wet work, such as, plastering, painting, and concrete are completely dry.

3.2 INSTALLATION

Panel installation shall be by personnel familiar with and normally engaged in installation of acoustical wall panels. Apply panels in accordance with the manufacturer's installation instructions. Submit manufacturer's installation instructions and recommended cleaning instructions.

3.3 CLEANING

Following installation, dirty or stained panel surfaces shall be cleaned in accordance with manufacturer's instructions and left free from defects. Panels that are damaged, discolored, or improperly installed shall be removed and new panels provided as directed.

-- End of Section --

SECTION 09 84 39

ACOUSTICAL CEILING CLOUDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

Other related sections include Section 09 51 00 ACOUSTICAL CEILINGS, Section 09 29 00 GYPSUM BOARD, Division 23 HVAC and Division 26 ELECTRICAL.

1.2 SUMMARY

This section includes acoustical clouds, attachment hangers and fasteners.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(2009c) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2010) Standard for the Installation of Sprinkler Systems

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

Layout and details of acoustical clouds. Show locations of items which are to be coordinated with acoustical clouds.

SD-03 Product Data

Acoustical Cloud Unit;

Submit manufacturer's technical data for each type of cloud system required.

SD-08 Manufacturer's Instructions

Installation instructions;

1.5 QUALITY ASSURANCE

1.5.1 Single Source Responsibility

Provide acoustical clouds and method of attachment by a single manufacturer.

1.5.2 Coordination of Work

Coordinate acoustical cloud work with installers of related work including, but not limited to suspended ceilings, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.5.3 Seismic Performance

The International Building Code allows architectural components to swing freely as long as they will not be damaged or cause damage. Soundscapes Shapes Acoustical Clouds suspended individually with aircraft cable will swing no more than 18 inches in any direction for each panel. Shapes direct attached to drywall or suspended in group systems have been engineered for application in all seismic areas.

1.5.4 Acoustical Clouds

Acoustical clouds, as with other architectural features located in the ceiling plane, may obstruct or skew the existing or planned fire sprinkler water distribution pattern, or possibly delay the activation of the fire sprinkler or fire detection system. Designers and installers are advised to consult a fire protection engineer, NFPA 13, and their local codes for guidance on the proper installation techniques where fire detection or suppression systems are present.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver acoustical clouds to project site in original, unopened packages and store them in a fully enclosed space between 40 degrees F and 120 degrees F where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes. All wet work (plastering, concrete, etc) must be complete and dry. Before installing acoustical clouds, permit them to reach room temperature and a stabilized moisture content. Handle acoustical clouds carefully to avoid damaging the surface and edges in any way.

1.7 PROJECT CONDITIONS

1.7.1 Space Enclosure

Building areas to receive acoustical clouds shall be free of construction dust and debris. Products can be installed in temperatures between 40

degrees F and 120 degrees F. Cannot be used in exterior applications, where standing water is present, or where moisture will come in direct contact with the acoustical cloud.

1.8 WARRANTY

1.8.1 Acoustical Clouds

Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical clouds that fail within the warranty period. Failures include, but are not limited to:

a. Acoustical clouds: Manufacturing defects or chipped or broken tiles.

b. Attachment devices: Rusting and manufacturing defects.

1.8.2 Warranty Period

Warranty Period shall be as follows:

a. Acoustical Clouds: One (1) year from date of substantial completion.

b. Attachment devices: One (1) year from date of substantial completion.

The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.1 ACOUSTICAL CLOUD UNITS

a. Surface Texture: See specifications on drawings.

b. Composition: See specifications on drawings.

c. Surface finish: See specifications on drawings.

d. Color: White

e. Shapes: Circle, see specifications on drawings and reflected ceiling plan.

f. Thickness: 7/8 inch

g. Flame Spread: ASTM E 84, Class A

h. Light Reflectance: (LR): ASTM E 1477, White: 0.90

i. Acoustical Absorption: ASTM C 423, White: Minimum 1.17 Sabins/sf

j. Recycle Content: Minimum 35 percent

k. Antimicrobial protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

2.2 ATTACHMENT SYSTEMS

Installation Hardware Kits for (individual suspension).

a. Deck Hanging Kit

b. Extended Hanging Cables

PART 3 EXECUTION

3.1 PREPARATION

Measure each ceiling area and establish layout of acoustical clouds and installation hardware. Comply with reflected ceiling plans. Coordinate panel layout with mechanical, electrical and sprinkler fixtures.

3.2 INSTALLATION

Install panels in accordance with the manufacturer's installation instructions, LA-297302, and in compliance with the authorities having jurisdiction.

3.3 ADJUSTING AND CLEANING

Replace damaged and broken tiles. Clean exposed surfaces of acoustical clouds per manufacturer's instructions.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100Doc	(2005) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 235	(2002; R 2007) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4263	(1983; R 2005) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4444	(2008) Use and Calibration of Hand-Held Moisture Meters
ASTM D 523	(2008) Standard Test Method for Specular Gloss
ASTM D 6386	(2010) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM F 1869	(2011) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

MASTER PAINTERS INSTITUTE (MPI)

MPI 107	(Oct 2009) Rust Inhibitive Primer (Water-Based)

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP-01	(2000) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Guide 6	(2004) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC Guide 7	(2004; E 2004) Guide to the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel
SSPC PA Guide 3	(1982; E 1995) A Guide to Safety in Paint Application
SSPC QP 1	(1998; E 2004) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
SSPC SP 1	(1982; E 2004) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP 12/NACE No.5	(2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SSPC SP 2	(1982; E 2004) Hand Tool Cleaning
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC VIS 1	(2002; e 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-680	(2010; Rev C) Degreasing Solvent

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(Rev D; Am 1) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1001	Asbestos
29 CFR 1910.1025	Lead
29 CFR 1926.62	Lead

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

SD-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Certification

Environmental Data

Materials;

Coating;

Manufacturer's Technical Data Sheets;

Indicate VOC content.

Sealant

SD-04 Samples

Color;

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

Qualification Testing laboratory for coatings;

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings:

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.3.2 SSPC QP 1 Certification

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4 NOT USED

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.4 Asbestos Content

Materials shall not contain asbestos.

1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.5.7 Human Carcinogens

Materials shall not contain ACGIH 0100Doc and ACGIH 0100Doc confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN.

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA Guide 3.

1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.

b. 29 CFR 1910.1000.

c. ACGIH 0100Doc, threshold limit values.

d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

e. The appropriate OSHA standards in 29 CFR 1910.1001 for surface preparation of painted surfaces containing asbestos. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

1.8 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. Isolate area of application from rest of building when applying high-emission paints or coatings.

1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Less than 5 degrees F above dew point;

b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.8.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.9 NOT USED

1.10 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs.

1.11 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be as indicated in the Finish Schedule specifications on drawings.

1.12 LOCATION AND SURFACE TYPE TO BE PAINTED

1.12.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.12.1.1 Exterior Painting

Includes new surfaces, existing coated surfaces, of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.12.1.2 Interior Painting

Includes new surfaces, existing uncoated surfaces, and existing coated surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.12.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

1.12.3 Mechanical and Electrical Painting

Includes field coating of interior new and existing surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation

(2) New aluminum jacket on piping

(3) New interior ferrous piping under insulation.

1.12.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material. In lieu of red enamel finish coat, provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals.

b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a

minimum dry film thickness of 1.0 mil. Provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals throughout the piping systems.

1.12.4 Definitions and Abbreviations

1.12.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.12.4.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

1.12.4.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.12.4.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.12.4.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.12.4.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.12.4.7 EXT

MPI short term designation for an exterior coating system.

1.12.4.8 INT

MPI short term designation for an interior coating system.

1.12.4.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.12.4.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.12.4.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.12.4.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.12.4.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.12.4.14 Paint

See Coating definition.

1.12.4.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.12.4.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 RESEALING OF EXISTING EXTERIOR JOINTS

3.2.1 Surface Condition

Surfaces shall be clean, dry to the touch, and free from frost and moisture; remove grease, oil, wax, lacquer, paint, defective backstop, or other foreign matter that would prevent or impair adhesion. Where adequate grooves have not been provided, clean out to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to adjoining work. Grinding shall not be required on metal surfaces.

3.2.2 Backstops

In joints more than 1/2 inch deep, install glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free of oil or other staining elements as recommended by sealant manufacturer. Backstop material shall be compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

3.2.3 Primer and Bond Breaker

Install the type recommended by the sealant manufacturer.

3.2.4 Ambient Temperature

Between 38 degrees F and 95 degrees F when applying sealant.

3.2.5 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Color(s) shall be selected by the Contracting Officer. Apply the sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Sealant shall be uniformly smooth and free of wrinkles.

3.2.6 Cleaning

Immediately remove fresh sealant from adjacent areas using a solvent recommended by the sealant manufacturer. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean condition. Allow sealant time to cure, in accordance with manufacturer's recommendations, prior to coating.

3.3 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.

b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D 235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.

c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.

d. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer.

e. Previously painted surfaces specified to be repainted or damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.

f. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.

g. Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8.

h. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.

i. Edges of chipped paint shall be feather edged and sanded smooth.

j. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.

k. New, proposed coatings shall be compatible with existing coatings.

3.3.2 Existing Coated Surfaces with Minor Defects

Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings. Remove chalking by sanding so that when tested in accordance with ASTM D 4214, the chalk rating is not less than 8.

3.3.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

a. Surfaces containing large areas of minor defects;

b. Surfaces containing more than 20 percent peeling area; and

c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

3.3.4 Substrate Repair

a. Repair substrate surface damaged during coating removal;

b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and

c. Clean and prime the substrate as specified.

3.4 PREPARATION OF METAL SURFACES

3.4.1 Existing and New Ferrous Surfaces

Ferrous Surface Preparation
SSPC Blasting/Cleaning Levelsa - Primer Types/Exposures

	Exposureb		
	Mild	Moderate	Severec
Primer Type	alkyd/oil latex oleoresinous phenolic	alkyd/oil latex oleoresinous phenolic	epoxy silicone inorganic zinc-rich
Surface Condition			
Uncoated			
Oil, grease, dirt	SP 1	for all moderate conditions, select from "mild" or "severe" for intended performance level	SP 10, SP 12 WJ2 or SP 5, SP 12 WJ1
Localized corrosion - mill scale, rust	SP 2, SP 3, or SP 7, SP 12 WJ-4		AS ABOVE
Extensive deterioration	SP 6d, SP 12 WJ-3		AS ABOVE
Shop coated			
Oil, grease, dirt	e		AS ABOVE
Localized damange to be spot repaired	SP 2, SP 3, or SP 7, SP 12 WJ-4		AS ABOVE
Extensive deterioration	SP 6d, SP 12 WJ-3		AS ABOVE

Existing coating			
Oil, grease	e	e	SP 1
Chalking, foreign matter other than oil or greese, localized deterioration	f		g
Extensive deterioration	SP 6d, SP 12 WJ-3		SP 10, SP 12 WJ2 or SP 5, SP 12 WJ1

a If it is not possible to abrasive blast or use water jetting, SP 11 is recommended. It is considered equivalent to SP 6. SP 11 is also preferred wherever SP 2 or SP 3 are shown in the Table.

b These are minimum requirements. A high-performing system may be a better choice forlonger performance.

c For marine, chemical, or immersion service, or application of heat resistant or nonslip floor coatings. SP 10 is preferred for zinc-rich primers, and for extremely severe environments where long-term performance is desired.

d Use water jetting to SP 12 WJ-3, as alternate to SP 6 degree ofcleanliness.

e Use only the steam clean, or non-alkaline detergent solutions of SP 1.

f First, remove chalk and dirt with a non-alkaline detergent solution, and follow with power wash at minimum 2000 psi. Second, spot clean, in order of preference by SP 6, SP 11, SP 7, SP 3, or SP2.

g First, remove chalk and dirt with a non-alkaline detergent solution, and follow with power wash at minimum 2000 psi. Second, spot clean, in order of preference, by SP 10, SP 6, or SP 11.

h SSPC SP 12/NACE No.5 provides four levels of water jetting cleanliness and they reflect thefour levels of abrasive blast cleanliness but direct correlation is inaccurate or inappropriate. Thefour levels are (best to worst): WJ-1, WJ-2, WJ-3, and WJ-4. They are equivalent to the abrasive blast standards SSPC SP 5, SP 10, SP 6, and SP 7. The standard also includes three levels of cleanliness for nonvisual contaminants, SC-1, SC-2, and SC-3. The preferred level of cleanliness is between SC-1or SC-2.

a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2. Brush-off blast remaining surface in accordance with SSPC SP 7/NACE No.4; Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/NACE No.3/SSPC SP 12/NACE No.5 WJ-3.

3.4.2 Final Ferrous Surface Condition:

Type Coating	Level of Cleaning, SSPC SP ...
a. Latex or Alkyd	2,3,6 or SP 12 WJ-2. (7 and 10, SP 12 WJ-2 or SP 12 WJ-1 may be left in as Contractor options)
b. High Performance (i.e. Epoxy, Urethane, others)	7,10

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

3.4.3 Galvanized Surfaces

a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 6386, Appendix X2, and remove by one of the methods described therein.

b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12/NACE No.5 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Spot abrasive blast rusted areas as described for steel in SSPC SP 6/NACE No.3, and waterjet to SSPC SP 12/NACE No.5, WJ3 to remove existing coating.

3.4.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.4.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D 235. Wipe dry with clean, dry cloths.

3.4.6 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water.

3.5 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.5.1 Concrete and Masonry

a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.

b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil:Wash new and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. Wash existing coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new , existing coated, and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.

c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet

in 24 hours as determined by ASTM F 1869. In all cases follow manufacturer's recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.5.2 Gypsum Board, Plaster, and Stucco

a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.

b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5.3 Existing Asbestos Cement Surfaces

Remove oily stains by solvent cleaning with mineral spirits, MIL-PRF-680. Remove loose dirt, dust, and other deleterious substances by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material. Do not wire brush or clean using other abrasive methods. Surfaces shall be dry and clean prior to application of the coating.

3.6 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.6.1 New Plywood and Wood Surfaces, Except Floors:

a. Wood surfaces shall be cleaned of foreign matter.

Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.

b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, 1 ounce (1/3 cup) household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

c. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D 4444, Method A, unless otherwise authorized.

d. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.

e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.

f. Cosmetic Repair of Minor Defects:

(1) Knots and Resinous Wood and Fire, Smoke, Water, and Color Marker Stained Existing Coated Surface: Prior to application of coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

3.7 APPLICATION

3.7.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while

painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 1.0 mil. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

e. Floors: For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.

3.7.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.7.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.7.4 Coating Systems

a. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.

b. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

c. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

   (1) One coat of primer.

   (2) One coat of undercoat or intermediate coat.

   (3) One topcoat to match adjacent surfaces.

d. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.8 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.9 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

3.10 COATING SYSTEMS FOR WOOD AND PLYWOOD

a. Apply coatings of Tables in Division 6 for Exterior and Interior.

b. Prior to erection, apply two coats of specified primer to treat and prime wood and plywood surfaces which will be inaccessible after erection.

c. Apply stains in accordance with manufacturer's printed instructions.

3.11 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with ASME A13.1. Place stenciling in clearly visible locations. On piping not covered by ASME A13.1, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.12 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.13 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers.

-- End of Section --

SECTION 10 14 02

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2004) Safety Glazing Materials Used in Buildings

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Installation;

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Samples

Interior Signage;

One sample of each of the following sign types showing typical quality, workmanship and color. The samples may be installed in the work, provided each sample is identified and location recorded.

a. Directional sign.

b. Standard Room sign.

1.3 GENERAL

Interior signage shall be of the design, detail, sizes, types, and message content shown on the drawings/attachments/signage placement schedule (as applicable), shall conform to the requirements specified, and shall be

provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Signage shall be obtained from a single manufacturer with edges and corners of finished letterforms and graphics true and clean.

1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials shall be packaged to prevent damage and deterioration during shipment, handling, storage and installation. Product shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

2.1.1 Standard Room Signs

Signs shall consist of acrylic plastic 0.080 inch thickness minimum conforming to ANSI Z97.1 and shall conform to the following:

Units shall be frameless. Corners of signs shall be rounded to as indicated.

2.1.2 Type of Mounting For Signs

Extruded aluminum brackets shall be furnished for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners. Surface mounted signs shall be mounted with 1/16 inch thick vinyl foam tape fabricated from materials that are not corrosive to sign material and mounting surface.

2.1.3 Graphics

Signage graphics for modular signs shall conform to the following:

Subsurface copy: Copy is transferred to the back face of clear acrylic sheeting forming the panel face to produce precisely formed opaque image. This method bonds all sign elements (color, graphics, lettering, braille and substrate) into a single unit.

2.1.4 Character Proportions and Heights

Letters and numbers on indicated signs which do not designate permanent rooms or spaces shall be as indicated on the drawings.

2.1.5 Raised and Brailled Characters and Pictorial Symbol Signs (Pictograms)

Raised and brailled characters and symbols are only required on signs that designate permanent rooms or spaces, including restrooms and room numbers.

They are not required for information or way-finding signs. Raised letters and numbers on signs must protrude 1/32 inch upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch in height, but no higher than 2 inches. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 6 inches minimum in height. Indicated accessible facilities shall use the international symbol of accessibility.

2.2 INDIVIDUAL CUT PLASTIC LETTERS

2.2.1 Fabrication

Letters shall be fabricated from laser cut or waterjet acrylic. Letters shall be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters shall be packaged for protection until installation.

2.2.2 Typefaces, Thicknesses, Colors and Sizes

Typefaces, thicknesses, colors and sizes are indicated on signage schedule, Sheet A-181.

2.2.3 Mounting

Letters shall be surface mounted to painted surfaces with double sided adhesive tape. Templates for mounting shall be supplied.

2.3 FABRICATION AND MANUFACTURE

2.3.1 Factory Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.4 COLOR, FINISH, AND CONTRAST

Color shall be as indicated on the drawings. Finish of all signs shall be eggshell, matte, or other non-glare finish as required in handicapped-accessible buildings.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed plumb and true and in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Distance from edge of door frame to edge of sign shall be as indicated on drawings. Required blocking shall be installed. Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until

finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

3.1.1 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Sign surfaces shall be cleaned at completion of sign installation in accordance with the manufacturer's approved instructions.

-- End of Section --

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A385/A385M	(2009) Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products

INTERNATIONAL CODE COUNCIL (ICC)

ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60003	(Basic) Partitions, Toilet, Complete

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SYSTEM DESCRIPTION

Provide a complete and usable toilet partition system, including toilet enclosures, room entrance screens, urinal screens, system of panels, hardware, and support components. Furnish the partition system from a single manufacturer, with a standard product as shown in the most recent catalog data. Submit Fabrication Drawings for metal toilet partitions and urinal screens consisting of fabrication and assembly details to be performed in the factory. Submit manufacturer's Cleaning and Maintenance Instructions with Fabrication Drawings for review.

1.2.1 Sustainable Design Requirements

1.2.1.1 Local/Regional Materials Documentation

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D 1972. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual.

a. Type 2: High Density Polyethylene (HDPE).

b. Type 3: Vinyl (Polyvinyl Chloride or PVC).

c. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings
Installation Drawings;

SD-03 Product Data

Cleaning and Maintenance Instructions
Colors And Finishes;
Anchoring Devices and Fasteners
Hardware and Fittings
Brackets Door
Hardware

SD-04 Samples

Colors and Finishes;
Hardware and Fittings
Anchoring Devices and Fasteners

SD-07 Certificates

Warranty

1.4 REGULATORY REQUIREMENTS

Conform to ICC/ANSI A117.1 code for access for the handicapped operation of toilet compartment door and hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the manufacturer's original unopened packages with the brand, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated; free from dust, water, other contaminants, and damage during delivery, storage, and construction.

1.6 WARRANTY

Provide certification or warranties that metal toilet partitions will be free of defects in materials, fabrication, finish, and installation and will remain so for a period of not less than 5 years after completion.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Anchoring Devices and Fasteners

Provide steel anchoring devices and fasteners hot-dipped galvanized after fabrication, in conformance with ASTM A385/A385M and ASTM A123/A123M. Conceal all galvanized anchoring devices.

2.1.2 Brackets

Wall brackets shall be two-ear panel brackets, T-style, 1-inch stock. Provide stirrup style panel-to-pilaster brackets.

2.1.3 Hardware and Fittings

2.1.3.1 General Requirements

Conform hardware for the toilet partition system to CID A-A-60003 for the specified type and style of partitions. Provide hardware finish highly resistant to alkalis, urine, and other common toilet room acids. Comply latching devices and hinges for handicap compartments with 36 CFR 1191; provide stainless steel devices and hinges with door latches that operate without either tight grasping or twisting of the wrist of the operator. Submit three samples of each item, including anchoring devices and fasteners. Approved hardware samples may be installed in the work if properly identified.

a. Corrosion-resistant steel shall conform to ASTM A167, Type 304.

2.1.3.2 Finishes

a. Aluminum shall have a clear anodic coating conforming to AA DAF45.

b. Corrosion-resistant steel shall have a No. 4 finish.

c. Exposed fasteners shall match the hardware and fittings.

2.1.4 Door Hardware

2.1.4.1 Hinges

Hinges shall be adjustable to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors to 10 degrees. Provide self-lubricating hinges with the indicated swing. Hinges shall be the surface-mounted type and have the following type of return movement:

a. Gravity return movement

2.1.4.2 Latch and Pull

Latch and pull shall be a combination rubber-faced door strike and keeper equipped with emergency access.

2.1.4.3 Coat Hooks

Coat hooks shall be combination units with hooks and rubber tipped pins.

2.2 PARTITION PANELS AND DOORS

Fabricate partition panels and doors not less than 1 inch thick.

2.2.1 Toilet Enclosures

Conform toilet enclosures to CID A-A-60003, Type I, Style A, floor supported, C, overhead braced. Furnish width, length, and height of toilet enclosures as shown. Provide a width of 1 inch. Finish surface of panels shall be solid phenolic, Finish 4; water resistant; graffiti resistant; non-absorbent. Enclosures shall contain a minimum of 20 percent post-consumer recycled plastic. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. This item may contain post-consumer or post-industrial recycled content. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required. Provide grab bars to withstand a bending stress, shear stress, shear force, and a tensile force induced by 250 lbf. Grab bars shall not rotate within their fittings.

2.2.2 Urinal Screens

Conform urinal screens to CID A-A-60003, Type III, Style A, floor supported, C, overhead braced. Provide finish for surface of screens as solid phenolic, Finish 4; water resistant; graffiti resistant; non-absorbent. Screens shall contain a minimum of 20 percent post-consumer recycled plastic. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements.This item may contain post-consumer or post-industrial recycled content. Furnish width and height of urinal screens as shown. Provide thickness of 1 inch. Secure wall hung urinal screens with a minimum of three wall stirrup brackets. Fabricate screens from the same types of panels and pilasters as the toilet partitions. Use corrosion-resistant steel fittings and fasteners. Include in LEED Documentation Notebook.

2.3 FLOOR-ANCHORED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0635 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a steel bar not less than 1/2 by 7/8 inch welded to the reinforced face sheets and having not less than two 3/8 inch round anchorage devices for securing to the floor slab. Provide anchorage devices complete with threaded rods, expansion shields, lock washers, and leveling-adjustment nuts. Trim piece at the floor shall be 3 inch high and fabricated from not less than 0.030 inch thick corrosion-resistant steel.

2.4 OVERHEAD-BRACED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0393 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a channel-shaped floor stirrup fabricated from not less than 0.0635 inch thick material and a leveling bolt. Secure the stirrup to the pilaster with not less than a 3/16 inch bolt and nut after the pilaster is leveled. Secure the stirrup to the floor with not less than two lead expansion shields and sheetmetal screws. Fabricate overhead brace from a continuous extruded aluminum tube not less than 1 inch wide by 1-1/2 inch high, 0.125-inch wall thickness. Finish shall be AA-C22A31 in accordance with AA DAF45. Set and secure brace into the top of each pilaster. Fabricate 3 inch high trim piece at the floor from not less than 0.030 inch thick corrosion-resistant steel.

2.5 PILASTER SHOES

Provide shoes at pilasters to conceal floor-mounted anchorage. Pilaster shoes shall be stainless steel. Shoes shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Pilaster shoes may contain post-consumer or post-industrial recycled content. Height shall be 3 inches.

2.6 HARDWARE

Hardware for the toilet partition system shall conform to CID A-A-60003 for the specified type and style of partitions. Hardware shall be pre-drilled by manufacturer. Hardware finish shall be highly resistant to alkalis, urine, and other common toilet room acids. Latching devices and hinges for handicap compartments shall comply with 36 CFR 1191 and shall be stainless steel door latches that operate without either tight grasping or twisting of the wrist of the operator. Screws and bolts shall be stainless steel, tamper proof type.Wall mounting brackets shall be continuous, full height, stainless steel, in accordance with toilet compartment manufacturer's instructions. Floor-mounted anchorage shall consist of corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor.

2.7 COLORS AND FINISHES

2.7.1 Colors

Provide manufacturer's standard color charts for color of finishes for toilet partition system components. Submit three samples showing a finished

edge on two adjacent sides and core construction, each not less than 12-inch square

2.7.2 Finishes No.4

Provide solid plastic fabricated of solid phenolic core with melamine facing sheets formed under high pressure rendering a single component section not less than one inch thick. Colors shall extend throughout the panel thickness. Provide exposed finish surfaces: smooth, waterproof, non-absorbent, and resistant to staining and marking with pens, pencils, or other writing devices. Solid plastic partitions shall not show any sign of deterioration when immersed in the following chemicals and maintained at a temperature of 80 degrees F for a minimum of 30 days:

a. Acetic Acid (80 percent)	Hydrochloric Acid (40 percent)
b. Acetone	Hydrogen Peroxide (30 percent)
c. Ammonia (liquid)	Isopropyl Alcohol
d. Ammonia Phosphate	Lactic Acid (25 percent)
e. Bleach (12 percent)	Lime Sulfur
f. Borax	Nicotine
g. Brine	Potassium Bromide
h. Caustic Soda	Soaps
i. Chlorine Water	Sodium Bicarbonate
j. Citric Acid	Trisodium Phosphate
k. Copper Chloride	Urea; Urine
l. Core Oils	Vinegar

PART 3 EXECUTION

3.1 PREPARATION

Take field measurements prior to the preparation of drawing and fabrication to ensure proper fits. Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work. Verify correct spacing of plumbing fixtures. Verify correct location of built in framing, anchorage, and bracing. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install partitions rigid, straight, plumb, and level, with the panels centered between the fixtures. Provide a panel clearance of not more than 1/2 inch and secure the panels to walls and pilasters with not less than two wall brackets attached near the top and bottom of the panel. Locate wall brackets so that holes for wall bolts occur in masonry or tile joints. Secure Panels to pilasters with brackets matching the wall brackets. Provide for adjustment due to minor floor variations. Locate head rail joints at pilaster center lines. Install adjacent components for consistency of line and plane. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors.

a. Secure panels to hollow plastered walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

b. Secure panels to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

c. Secure panels to solid masonry or concrete with lead or brass expansion shields designed for use with not less than 1/4-20 screws, with a shield length of not less than 1-1/2 inch. Expansion shields shall have a load-carrying strength of not less than 600 pounds per anchor.

d. Submit Installation Drawings for metal toilet partitions and urinal screens showing plans, elevations, details of construction, hardware, reinforcing and blocking, fittings, mountings and escutcheons. Indicate on drawings the type of partition, location, mounting height, cutouts, and reinforcement required for toilet-room accessories.

3.3 FLOOR-ANCHORED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level tops of doors with tops of pilasters when doors are in a closed position. Expansion shields shall have a minimum 2-inch penetration into the concrete slab.

3.4 OVERHEAD-BRACED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Secure overhead brace to the pilaster face with not less than two fasteners per face. Expansion shields shall have a minimum 2-inch penetration into the concrete slab. Make tops of doors parallel with the overhead brace when doors are in a closed position.

3.5 FINAL ADJUSTMENT

After completion of the installation, make final adjustments to the pilaster-leveling devices, door hardware, and other working parts of the partition assembly. Doors shall have a uniform vertical edge clearance of approximately 3/16 inch and shall rest open at approximately 30 degrees when unlatched.

3.6 CLEANING

Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Clean all surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner compliant with the manufacturer's recommended cleaning and protection from damage procedures until accepted. Remove all equipment, tools, surplus materials, and work debris from the site.

-- End of Section --

SECTION 10 22 13

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wire mesh partitions;

Show layout, details, materials, dimensions, finishes, and all information necessary for fabrication and installation.

SD-03 Product Data

Wire mesh partitions;

Submit for each type of partition and door.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in manufacturer's original, unopened containers or packaging with labels intact and legible. Deliver, store, and handle

materials so as to prevent damage. Replace damaged or defective materials with new.

1.4 NOT USED

1.5 DESCRIPTION OF WORK

Wire mesh partitions shall be all wire type, heavy duty for extra heavy industrial use, and shall be provided complete with fasteners, capping bars, adjustable floor sockets, bracing, doors, hardware, and other items necessary for a complete, useable, and rigid installation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Shapes, Plates, and Bars

ASTM A36/A36M.

2.1.2 Cold-Formed Steel

AISI SG03-3.

2.1.3 Wire Mesh

Carbon steel wire, woven diamond mesh, intermediate crimped.

2.1.4 Floor Sockets

Cast or forged steel or ductile iron, adjustable, approximately 2-1/2 inches high.

2.2 NORMAL DUTY PARTITIONS

2.2.1 Wire Mesh

10 gage wire, 1-1/2 inch mesh.

2.2.2 Vertical Frames

1-1/4 by 5/8 inch cold-rolled C section channels or 1-1/4 by 5/8 by 1/8 inch channels.

2.2.3 Horizontal Frames

1 by 5/8 inch channels.

2.2.4 Center Reinforcing Bar

One 1 by 1/2 by 1/8 inch channel with all wires woven through, or two 1 by 3/8 by 1/8 inch channels bolted together with mesh in between.

2.2.5 Capping Bar

2-1/4 by one by 1/8 inch channel or 2 by 1/4 inch flat bar.

2.2.6 Corner Posts

Structural steel angles, 1-1/4 by 1-1/4 by 1/8 inch.

2.2.7 Line Posts

Unless otherwise indicated, provide partitions more than 12 feet high with flat bar line posts bolted between vertical frame channels. Sizes of posts shall be as follows:

Partition Height	Size of Posts
12 feet to 14 feet 8 inches	1-3/4 by 5/16 inch or 2 by 1/4 inch
14 feet 8 inches to 19 feet 8 inches	2-1/2 by 5/16 inch
19 feet 8 inches to 23 feet 8 inches	3 by 5/16 inch

2.2.8 Hinged Doors

Frames shall be 1-1/4 by 1/2 by 1/8 inch channels with 1-1/4 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-3/8 by 3/4 by 1/8 inch angle riveted to the lock stile. Provide 1 1/2 pairs of regular weight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

2.2.9 Sheet Metal Base

Hot- or cold-rolled sheet steel, not lighter than 16 gage.

2.3 HEAVY DUTY PARTITIONS

2.3.1 Wire Mesh

6 gage wire, 2 inch mesh.

2.3.2 Panel Frames

1-1/2 by 3/4 by 1/8 inch steel channels.

2.3.3 Center Reinforcing Bar

One 1-1/2 by 3/4 by 1/8 inch channel with all wires woven through, or two 1-1/4 by 3/8 by 1/8 inch channels bolted together with mesh in between.

2.3.4 Capping Bar

Structural steel channel, 3 inch by 4.1 pounds.

2.3.5 Corner Posts

Structural steel angles, 1-3/4 by 1-3/4 by 1/8 inch.

2.3.6 Line Posts

Unless otherwise indicated, provide partitions with flat bar line posts bolted between vertical frame channels. Sizes of posts shall be as follows:

Partition Height	Size of Posts
7 feet to 12 feet	2-1/2 by 5/16 inch
12 feet to 16 feet	3 by 5/16 inch or 2-1/2 by 3/8 inch
16 feet to 20 feet	3-1/2 by 5/16 inch

2.3.7 Hinged Doors

Frames shall be 1-1/2 by 3/4 by 1/8 inch channels with 1-1/2 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-5/8 by 7/8 by 1/8 inch angle riveted to the lock stile. Provide 1-1/2 pairs of heavyweight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

2.4 DOOR OPENING FRAMES

Provide frames the same size and shape as the vertical frames for the mesh panels.

2.5 LOCKS

Provide each door with a mortise type lock as coordinated with the COR.

2.6 FABRICATION

2.6.1 Standard Panels

Wire shall be woven into diamond mesh, intermediate crimped, and securely clinched to frames. Joints shall be mortised and tenoned. Wire shall be continuous at center reinforcing bars, either woven through a single channel or bolted between two channels. Panel vertical frames shall have 3/8 inch bolt holes 18 inches o.c. for heavy duty partitions.

2.6.2 Doors

Construction shall be similar to that specified for panels. Wire mesh shall be the same as that used in the adjacent partition panels.

2.6.3 Finish

Thoroughly clean ferrous metal, treat with phosphate, and paint with gray enamel in the shop.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wire Mesh Partitions

Install plumb, level, and true to line, within a tolerance of 1/8 inch in 10 feet or the height or run of the partition, if less than 10 feet. Anchor floor sockets to the floor with expansion bolts. Vertical frames and posts

shall be bolted together with 3/8 inch bolts 18 inches o.c. for heavy duty partitions. Secure top frames to a continuous capping bar with 1/4 inch diameter U bolts not more than 28 inches o.c.

3.1.2 Doors

Install in accordance with the manufacturers' recommendations. Adjust as required so that doors and hardware operate freely and properly.

3.1.3 Bracing

Brace free standing partitions more than 20 feet in length, at intervals not greater than 20 feet with a steel channel brace connected to the capping bar and anchored to the building wall or framing member.

3.1.4 Touch-Up

Clean and paint scratches, abrasions, and other damage to shop painted surfaces to match the shop-applied finish.

-- End of Section --

SECTION 10 26 13

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D 256	(2010) Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D 543	(2006) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 21	(2009) Determining Resistance of Synthetic Polymeric Materials to Fungi

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(2005) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards;
Wall Guards (Bumper Guards);
Wall Covering/Panels;

SD-04 Samples

Finish;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep materials dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 70 degrees F for at least 48 hours prior to installation.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

To the maximum extent possible, corner guards, door and door frame protectors, wall guards (bumper guards), wall panels and wall covering shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Provide resilient material consisting of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic conforming to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 18 ft-lbs/sq. inch when tested in accordance with ASTM D 256, (Izod impact, ft-lbs per sq inch notched).

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.4 Chemical and Stain Resistance

Materials shall be resistant to chemicals and stains reagents in accordance with ASTM D 543.

2.1.1.5 Fungal and Bacterial Resistance

Materials shall be resistant to fungi and bacteria in accordance with ASTM G 21, as applicable.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards

Corner guard units shall be surface mounted type, radius formed to profile shown. Corner guards shall be 8 feet high. Mounting hardware, cushions, and base plates shall be furnished. Assembly shall consist of a snap-on corner guard formed from high impact resistant resilient material, mounted on a continuous aluminum retainer. Extruded aluminum retainer shall conform to ASTM B221, alloy 6063, temper T5 or T6. Flush mounted type guards shall act as a stop for adjacent wall finish material. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards. Flush mounted corner guards installed in fire rated wall shall maintain the rating of the wall. Insulating materials that are an integral part of the corner guard system shall be provided by the manufacturer of the corner guard system. Exposed metal portions of fire rated assemblies shall have a paintable surface.

2.2.2 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 18 gauge thick material conforming to ASTM A167, type 302 or 304. Corner guards shall be 8feet high. Corner guard shall be formed to dimensions shown.

2.3 WALL COVERING/PANELS

Provide wall covering/panels consisting of high impact rigid acrylic vinyl or polyvinyl chloride resilient material. Panel sizes shall be 4 x 8 feet. Submit fire rating and extinguishing test results for resilient material. Also submit statements attesting that the items comply with specified fire and safety code requirements.

2.3.1 Rigid Vinyl Acrylic Wall Covering

Wall covering thickness shall be 0.040 inch.

2.4 TRIM, FASTENERS AND ANCHORS

Provide vinyl trim, fasteners and anchors for each specific installation as shown.

2.5 FINISH

Submit three samples indicating color and texture of materials requiring color and finish.

2.5.1 Aluminum Finish

Finish for aluminum shall be in accordance with AA DAF45. Exposed aluminum shall be designation AA-C22A31 chemically etched medium matte, with clear anodic coating, AA-C22A32 chemically etched medium matte with integrally colored anodic coating class II architectural coating 0.4 mil thick. Concealed aluminum shall be mill finish as fabricated, uniform in natural color and free from surface blemishes.

2.5.2 Stainless Steel Finish

Finish for stainless steel shall be in accordance with ASTM A167, Type 302 or 304, finish number 4.

2.5.3 Resilient Material Finish

Finish for resilient material shall be embossed stipple texture with colors in accordance with SAE J1545.

2.6 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.7 COLOR

Color shall be as indicated on the drawings and selected from manufacturers standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

3.1.2 Door, Door Frame Protectors, and Wall Panels

Surfaces to receive protection shall be clean, smooth, and free of obstructions. Protectors shall be installed after frames are in place, but prior to hanging of doors, in accordance with manufacturer's specific instructions. Adhesives shall be applied in controlled environment in accordance with manufacturer's recommendations. Protection for fire doors and frames shall be installed in accordance with NFPA 80.

3.1.3 Stainless Steel Guards

a. Mount guards on external corners of interior walls, partitions and columns as in accordance with manufacturer's recommendations.

b. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards as indicated and expansion bolted to concrete or masonry with four 3/8 inch diameter bolts, spaced 16 inches on centers. Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Corner guards shall overlap finish plaster surfaces.

c. Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, anchor corner guards to existing walls with 1/4 inch oval head stainless steel countersunk expansion or toggle bolts. Grout spaces solid between guards and backing with portland cement and sand mortar.

d. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

e. For wall guards, space brackets at no more than 3 feet on centers and anchor to the wall in accordance with the manufacturer's installation instructions.

-- End of Section --

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1036 (2006) Standard Specification for Flat Glass

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes;
Accessory Items;

SD-04 Samples

Finishes;
Accessory Items;

1.3 DELIVERY, STORAGE, AND HANDLING

Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited for use with the supporting construction. Provide tamperproof design exposed fasteners with finish to match the accessory.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

Metal	Finish
Stainless steel	No. 4 satin finish

2.2 ACCESSORY ITEMS

Conform to the requirements for accessory items specified below. Submit fasteners proposed for use for each type of wall construction, mounting, operation, and cleaning instructions and one sample of each other accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted. Submit certificate for each type of accessory specified, attesting that the items meet the specified requirements.

2.2.1 Facial Tissue Dispenser (FTD)

Provide surface mounted facial tissue dispenser, Type 304 stainless steel face, satin finish. Secure face of recessed dispenser by friction with suitable spring steel clips. Provide a minimum capacity of 150 two-ply tissues for dispenser.

2.2.2 Grab Bar (GB)

Provide an 18 gauge, 1-1/4 inch grab bar OD Type 304 stainless steel. Provide form and length for grab bar as indicated. Provide concealed mounting flange. Provide grab with satin finish. Furnish installed bars capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 1-1/2 inch space between wall and grab bar.

2.2.3 Mirrors, Glass (MG)

Provide Type I transparent flat type, Class 1-clear glass for mirrors. Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.4 Paper Towel Dispenser (PTD)

Provide paper towel dispenser constructed of a minimum 0.03 inch Type 304 stainless steel, surface mounted. Furnish tumbler key lock locking mechanism.

2.2.5 Sanitary Napkin Disposer (SND)

Construct a Type 304 stainless steel sanitary napkin disposal with removable leak-proof receptacle for disposable liners. Provide fifty disposable liners of the type standard with the manufacturer. Retain receptacle in cabinet by tumbler lock. Provide disposer with a door for inserting disposed napkins, surface mounted.

2.2.6 Sanitary Napkin and Tampon Dispenser (SNTD)

Provide sanitary napkin and tampon dispenser surface mounted. Dispenser, including door of Type 304 stainless steel that dispense both napkins and tampons with a minimum capacity of 20 each. Furnish dispensing mechanism for complimentary operation. Hang doors with a full-length corrosion-resistant steel piano hinge and secure with a tumbler lock. Provide keys for coin box different from the door keys.

2.2.7 Soap Dispenser (SD)

Provide soap dispenser surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.8 Toilet Tissue Dispenser (TTD)

Furnish Type II - surface mounted toilet tissue holder with two rolls of standard tissue mounted horizontally. Provide stainless steel, satin finish cabinet.

2.2.9 Waste Receptacle (WR)

Provide Type 304 stainless steel waste receptacle, designed for surface mounting. Provide reusable liner, of the type standard with the receptacle manufacturer. Provide a minimum 15 cubic feet capacity. Provide receptacles with push doors and doors for access to the waste compartment with continuous hinges. Furnish tumbler key lock locking mechanism.

2.2.10 Toilet Seat Cover Dispenser (TSCD)

Provide Type 304 stainless steel with surface mounted toilet seat cover dispensers. Provide dispenser with a minimum capacity of 500 seat covers.

2.2.11 Mop and Broom Holder (MH)

Stainless steel with grip jaw cam mechanism securing 4 mop or broom handles. Also includes hooks and storage shelf.

PART 3 EXECUTION

3.1 INSTALLATION

Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Provide oval exposed screw heads. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the

installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone or polysulfide sealant) as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates.Install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

-- End of Section --

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFC	(2009) International Fire Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1	(2009) Fire Code
NFPA 10	(2010) Standard for Portable Fire Extinguishers
NFPA 101	(2012) Life Safety Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.157	(2003) Portable Fire Extinguishers

UNDERWRITERS LABORATORIES (UL)

UL 299	(2002; Reprint Apr 2009) Dry Chemical Fire Extinguishers

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit Manufacturer's catalog and warranty data for the following items:

Cabinets;
Wall Brackets;

1.3 DELIVERY, HANDLING, AND STORAGE

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

PART 2 PRODUCTS

2.1 NOT USED

2.2 NOT USED

2.3 NOT USED

2.4 NOT USED

2.5 CABINETS

2.5.1 Material

Provide corrosion-resistant steel cabinets.

2.5.2 Type

Provide semi-recessed cabinet for a 4-inch wall.

2.5.3 Size

Dimension cabinets to accommodate the specified fire extinguishers.

2.6 WALL BRACKETS

Provide wall-hook fire extinguisher wall brackets.

Provide wall bracket and accessories as approved.

PART 3 EXECUTION

3.1 INSTALLATION

Install where indicated on the drawings. Verify exact locations prior to installation.

Comply with the manufacturer's recommendations for all installations.

3.2 ACCEPTANCE PROVISIONS

3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

3.2.2 Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

-- End of Section --

SECTION 11 13 10

DOCK LEVELERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS C2.18	(1993; Errata 1993) Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A143/A143M	(2007) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA MG 1	(2009) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 943 (2006; Reprint May 2010) Ground-Fault Circuit-Interrupters

1.2 DEFINITIONS

1.2.1 Industrial Dock Leveler

A manufactured structure designed to span and compensate space and height differentials between a loading dock and freight carrier to facilitate safe, efficient, freight transfer.

1.2.2 Adjustable Loading Ramp

Synonym for Fixed Type Industrial Dock Leveler.

1.2.3 Fixed Type Industrial Dock Leveler

A dock leveler that is permanently affixed to the dock structure, and usually incorporating an electro-hydraulic recessed into dock face further than 15 inch system to position the dock leveler with respect to the freight carrier at the lip end while being fixed at the opposite hinged end.

1.2.4 Velocity Fuse

A valve or similar device that goes into the hydraulic line. If the dock leveler becomes inadvertently or accidentally unsupported, this fuse will freeze the movement of dock leveler within 4 inches of the dock leveler original position.

1.2.5 Carrier

A wheeled, enclosed trailer or container that, when attached to a heavy-duty truck or van, is used to carry bulk freight over long distances.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Loading Dock Levelers; G
Dock Bumpers; G

SD-04 Samples

Fastening Materials
Angles
Rods
Fastening Hardware

Dock Bumpers
Rubber Rubberized
Fabric

SD-07 Certificates

Fastening Materials
Rubberized Fabric
Steel Angles
Hardware Items

SD-10 Operation and Maintenance Data

Loading Dock Levelers, Data Package 3; G

SD-11 Closeout Submittals

Record Drawings; G

1.4 QUALITY ASSURANCE

1.4.1 Manufacturer's Representative

Furnish services of Fixed Type Industrial Dock Leveler technicians, experienced in installation and operation of the type of system being provided, to supervise installation, testing, adjustment of system, and instruction to Government personnel.

1.4.2 Detail Drawings

Submit drawings depicting dimensions, tolerances, surface finishes, hardness, flush edge angles, method of mounting and anchoring, and control schematics and diagram. Show complete wiring, schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show proposed layout and anchorage of equipment and appurtenances on Drawings. Show the concrete pit details including flush edge angles, dock bumpers including fastening materials in compliance with ASTM A123/A123M and ASTM D 2000, and sloped pit bottom; method of mounting and anchoring; and location of control stations and disconnect switches on Drawings. For vertical, edge-of-dock, and free-standing board dock levelers, show details of required pit or foundation construction and dock bumpers and structural shapes installation, in lieu of concrete pit details on Drawings. Show all proposed dock bumper locations on drawings.

1.4.3 Record Drawings

Submit record as-built drawings depicting dimensions, tolerances, surface finishes, harnesses, flush edge angles, method of mounting and anchoring, and control schematics and diagram, including mechanical and electrical components, testing and acceptance (one copy sepia transparency) for each industrial dock leveler.

1.5 DELIVERY, STORAGE, AND HANDLING

Matchmark and tag parts which are disassembled for shipment with metal tags. Provide waterproofed tags and markings. Protect the delivered equipment in

storage from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.6 EXTRA MATERIALS

After approval of the detail drawings, and not later than 2 months prior to the date of beneficial occupancy, provide spare parts data for each different item of material and equipment specified. Furnish a complete list of parts and supplies, with current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 3 year(s) of service.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Standard Products

Submit data including a complete list of equipment and materials, manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Provide materials and equipment, which are the standard products of a manufacturer regularly engaged in the manufacture of the products, and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this Section, with the additions and modifications specified herein.

2.1.2 Exposed Surfaces

All exposed metal surfaces and fastening materials shall fully comply with the minimum requirements of ASTM A123/A123M, ASTM A143/A143M, and ASTM A153/A153M.

2.1.3 Nameplate

Attach corrosion-resistant metal plate securely and legibly on the exterior surface of the dock leveler. Include the following information indented or embossed on the plate:

a. Description of the equipment: Describe procedures for operating and services equipment, and warnings or cautions of hazardous procedures.

b. Name of the manufacturer.

c. Serial and model number.

d. Rated capacity in pounds.

e. Shipping weight.

f. Date of manufacture (month and year).

2.1.4 Toe Guards or Skirts

Provide sides or edges, except front and rear edges, of the ramps which rise above the surrounding loading dock with sheet carbon steel skirts or toe guards of minimum 14 U.S.S. gage nominal thickness. Furnish smooth faced toe guards or skirts and mount flush with the edges of the ramp surface. Ensure sufficient depth of toe guards or skirts to protect the full operating range of dock travel. Ensure the construction capable of resisting a minimum lateral force of 10 pounds with a maximum deflection of 1/2 inch.

2.2 LOADING DOCK LEVELERS

Provide permanent loading dock levelers with minimum performance characteristics based on the following:

a. Service Period:
   (1) Number of shift operations: 2.
   (2) Maximum number of trucks per shift opening: 4.
   (3) Maximum number of days per week: 7.

b. Fork Lift Loads:
   (1) Design levelers to accommodate 3 and 4 wheel fork trucks.
   (2) Design levelers to handle 20,000 LB gross dynamic load.
   (3) Base load leveler design on number of cycles per loading/unloading operation per truck.

Provide loading dock leveler with electro-hydraulic type with electric motor and hydraulic pump operating a hydraulic cylinder that adjusts dock leveler board position. Make provision for maintenance access to understructure and lifting mechanism. Provide steel tread plate lip and platform, hinged and supported from beneath by steel framework that contains lifting, positioning, and lowering assembly. Ensure that platform surface is flush with surrounding floor surface of loading dock when not in service. Provide integral positive restraint when leveler is in maintenance position.

2.2.1 Design Requirements

Design, fabricate, and finish loading ramp to permit washing with water and detergents, and operating in an ambient temperature from 0 to plus 110 degrees F.

2.2.2 Dock Leveler Height Adjustment

Provide a ramp whose incline can be adjusted to suit the height of the freight carrier. Allow the loading ramp a minimum of 24 inches of vertical adjustment. Divide height adjustments 12 inches above and 12 inches below the dock level to provide coverage between 30 and 54 inches and 44 inches above grade.

2.2.3 Dock Leveler Extension and Retraction

Extend non-fixed end of the dock leveler from a retracted position behind the line of the loading dock platform bumpers to at least 12 inches beyond the forward edge of the dock platform bumpers so as to rest on the bed of the freight carrier. The difference in length of the platform from its fully retracted position to its fully extended position shall be practically constant throughout the ramp, including the ramp extension.

2.2.4 Loading Ramp Compensation

Provide automatic compensation with ramp platform loaded or unloaded for:

2.2.4.1 Freight Carrier Out of Level

Out of level freight carrier bed condition (difference in elevation from side to side at the rear of the carrier bed): Allow a minimum correction of one inch for each 18 inches and maximum 4 inch correction of ramp width over the width of the ramp. Ensure the rear edge of the ramp parallel with the rear of the frame in order to prevent tripping or be a pinching hazard.

2.2.4.2 Loading and Unloading of the Freight Carrier

Provide mechanical type dock levelers with manual load compensation for truck beds lowered below dock height. When the lip is extended so as to rest on the bed of motor truck or trailer, provide compensation of 4 inches for carrier spring deflection so that contact will be maintained between lip and carrier bed.

2.2.5 Safety Devices

2.2.5.1 Electro-Hydraulic System

Provide velocity fuse, ballcheck valve, or other device to automatically prevent a drop of more than 4 inches of the lip, should the freight carrier move away from the dock leaving the lip unsupported. Activate this device with a static, dynamic, or impact load exceeding 10 percent of the rated load on the lip and ramp.

2.2.5.2 Dock Bumpers

Submit certificates showing conformance with the referenced standards contained in this section. Provide ramp and load dock face with laminated rubber, tire-fabric, or equivalent dock bumpers recommended by the dock leveler manufacturer. Submit one typical Loading Dock Bumper completely assembled with supporting rods, end angles, bolts, and nuts. (This may be the smallest size bumper required.) One section of 8 inches wide by full depth and height of bumper including one end angle with the opposite end exposed for inspection.Solid Rubber pieces conforming to ASTM D 2000, Grade 4AA612A13B13F17 may be used instead of rubberized fabric.

a. Construct bumpers of resilient, laminated, rubberized-fabric pads, assembled on steel frames. Rubberized Fabric shall conform to ASTM D 2000. Punch material to receive 3/4 inch supporting rods. Bumpers shall be 4-1/2 inches thick, stand out from the dock, and be closed with two structural steel angles under 1,500 pounds.

b. Finish: Metal for dock bumpers, including Hardware Items, shall be hot-dip galvanized conforming to ASTM A123/A123M.

2.2.6 Rated Capacity

Minimum 20,000 pounds roll over capacity.

2.2.7 Ramp Load Carrying Surface

The live load carrying surface of the ramp shall be 6 feet plus or minus 3 inch wide and 10 feet plus or minus 9 inch long with the dock leveler lip retracted.

2.3 OPERATION

2.3.1 Electro-Hydraulic Control

Provide each dock leveler with a pushbutton station to activate motor, pump, and valves.

2.3.1.1 Pushbutton

Heavy-duty dust tight and oil tight type rated in accordance with NEMA ICS 2, Part ICS2-216 for alternating current. To prevent accidental operation and damage, ensure each button to be recessed in its station or be protected by a peripheral collar (ring) or shroud. Indelibly identify each pushbutton by means of cast or etched letters on the station. Provide emergency "STOP" button of momentary type with manual reset or continuous pressing (constant pressure) type. This stop button shall stop all dock leveler movement, regardless of the position of the ramp or lip at the time the "STOP" button is depressed.

2.3.1.2 Hinged Lip Ramp Movement

Apply continuous pressure on the "UP" button to raise the loading ramp, descend the lip onto the bed of the freight carrier. Once the freight carrier has departed, the lip shall automatically fall or retract to its down position, and the ramp shall return to its stored dock level position. The ramp, in its stored position, shall have the capability of being lowered below dock level without extending the lip of the ramp to service truck end loads which may be lower than loading dock surface position. Allow 4 to 6 seconds to fully extend or retract the lip.

2.4 CONSTRUCTION AND MATERIALS

Construct all load carrying parts of forged or welded steel. The entire live load carrying surface of the ramp and rear attachment shall be not less than 1/4 inch thick, 55 ksi minimum yield strength, low alloy, nonskid steel tread plate. Provide minimum 5/8 inch vertical projections on the live load carrying surface. Bevel the lip or ramp extension. Design load carrying surfaces to permit free movement of powered hand or platform trucks, low lift pallet trucks, and fork lift trucks. Fabricate lip hinge of not less than 1/4 inch wall seamless steel tubing.

2.5 ELECTRO-HYDRAULIC SYSTEM

Provide a separate and complete system for each dock leveler. Include an electric motor, motor drive, hydraulic pump, hydraulic ram, pressure relief valve, fluid reservoir, strainer, filter, hydraulic control-valve cylinders, hose, piping, fittings, and hydraulic fluid. Incorporate a means for filling and draining hydraulic fluid. Design cylinders, pump, and control valves to withstand not less than 150 percent of the design operating pressure. Provide hydraulic hose, fittings, pipe, and tubing with working pressures based upon a minimum 4 to 1 safety factor of bursting pressure.

2.6 ELECTRICAL REQUIREMENTS

NFPA 70, NEMA ICS 2, NEMA ICS 6 and NEMA MG 1. Provide 230 volt electrical characteristics, three phase, 60 Hz alternating current power supply. Provide all electrical equipment on the loading ramp. Provide interconnecting wiring for components of packaged equipment as an integral part of the equipment. Include motor, switches, junction box, conduit, wiring cables, panel enclosed control station, motor controller, heater coils, timer, transformer, terminal blocks, and fuses. Provide NEMA ICS 6, Type 4, electrical enclosures. Color code all wiring.

2.6.1 Motor

Conform to NEMA MG 1 and continuous duty or 60-minute time rated, industrial type, single speed rated for operating conditions. Provide electrical insulation systems conforming to NEMA MG 1, Class B. Provide permanently lubricated antifriction ball or roller bearings. Equip each electrohydraulic loading dock leveler with a totally enclosed fan cooled (TEFC) squirrel cage induction electric motor. Equip each air powered loading dock leveler with a 115v, single phase, 60 Hz, self cleaning, two stage, UL approved industrial fan motor, which will not exceed its rated capacity under full load conditions of the loading dock leveler.

2.6.2 Controls

NEMA ICS 2, size 0 controller for heavy industrial service. Provide an electrically operated, full magnetic, nonreversing type controller for the motor. Equip all control enclosures with locks and keys.

2.6.3 Transformer

Totally enclosed, self-cooled, dry type. Feed the transformer from the load side of the main disconnecting device. Incorporate circuit breakers with ground fault interrupting protection conforming to UL 943.

2.7 ACCESSORIES

2.7.1 Dock Bumpers

Provide bumpers capable of sustaining repeated impacts from trucks or trailers without damage to the dock, dock levelers, or bumpers.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

Install and adjust in accordance with NFPA 70, manufacturer's approved detail drawings, and as-built system assembly drawings. Install controls so operator can see dock leveler while manipulating controls. Do not pour the pit for the adjustable loading ramp until the design and detail drawings have been approved. If the pit size is limited by construction conditions

involved, alter the dock leveler equipment to fit the pit. Clearly indicate these alterations or modifications on the drawings. Check and verify the appropriate measurements at the building. Do not exceed 2 inch clearances between the ramp and pit.

3.3 CLEANING, TREATMENT AND PAINTING

In accordance with manufacturer's standard practice, shop clean, treat and paint ferrous surfaces including platform, lip, frame, springs, motor, pump, cylinders, valves, and any other non-cadmium plated or non-galvanized surface (but not including bearings, gear contact surfaces, parts protected by lubrication, or other surfaces not usually painted or coated). Clean ferrous surfaces, shot pen, and protect the base metal with an application of 99.9 percent pure zinc coating with a thickness of 0.010 to 0.012 in accordance with AWS C2.18 and protect the base metal with an application of Rustoleum paint with a thickness of 2.5 to 3 mils followed by a final coat of standard primer with a thickness of 2.5 to 3 mils. Protect nonferrous parts against corrosion as necessary.

3.3.1 Workmanship

Conduct field touch-up work as to avoid damaging other surfaces and public property in the area. Do not apply field applied paint during foggy, damp, rainy weather, or the ambient temperatures below 45 degrees F and above 95 degrees F.

3.3.2 Dissimilar Metals Protection

Insulate control surfaces by electrolytically inactive materials.

3.3.3 Finish Coat Color

Brilliant yellow and black. Paint 3 inch wide black and yellow diagonal stripes on all vertical surfaces of pit, skirts, and platform edges exposed above adjacent surfaces at any ramp position. Paint similar stripes on top of ramp surfaces in 6 inch wide band around outside edges (except for fixed edge).

3.4 FIELD TESTS

Provide personnel, instruments, materials, and equipment, including test vehicles, for the administration and direction of the tests. Correct defects and repeat tests under the cognizance of the Contracting Officer and the dock leveler manufacturer. The Contracting Officer is responsible for certifying the test load.

3.4.1 Roll-Over Load Tests

Move roll-over load of 20,000 pounds over the dock leveler between the bed of a freight carrier and the building loading dock surface for 10 cycles. With the ramp extension retracted and the ramp platform leveled with the building loading dock surface, run a 20,000 pound roll-over load over the ramp in various directions for 20 cycles. Do not allow permanent deformation or hydraulic system leakage to occur subsequent to examination after these roll-over tests.

3.4.2 Drop Tests

Twice, drop test the dock leveler at the indicated rated capacity as follows: With the load on the platform and the lip resting on a vehicle carrier bed not less than 10 inches above loading dock surface, pull the carrier or pull away from the lip, leaving the loading ramp unsupported. Do not exceed 4 inch for the measured vertical drop of the dock leveler taken at the point where the lip rests on the vehicle carrier during each of the drop tests. Inspect the loading ramp after each drop and ensure no damage or distortion to the mechanical, electrical or structural components. Do not allow leakage from the hydraulic system.

3.4.3 Acceptance Tests

Perform an acceptance test in the presence of the dock leveler manufacturer and the Contracting Officer subsequent to roll-over load tests and drop tests. Conduct operation of the equipment through all of its motions and specified checks as follows: (a) extend lip to rest on a variety of freight carriers with beds up 12 inch above and below dock level; (b) test 4 inch drop limitation with 7000 pound load on ramp, evenly distributed; (c) test level compensation with the ramp, loaded with a minimum of 7000 pounds; and (d) test proper compensation (float) for various compression of countersprings, with ramp loaded and unloaded.

3.5 INSTRUCTION TO GOVERNMENT PERSONNEL

Upon completion of the work and at a time designated by the Contracting Officer, provide the services of a competent Technician regularly employed or authorized by the manufacturer of the dock leveler to instruct Government personnel in the proper operation, maintenance, safety, and emergency procedures of the dock leveler. A minimum of one and no more than two eight-hour working days of instruction is required. Conduct the training at the job site or at any other location mutually satisfactory to the Government and the Contractor.

3.6 OPERATING MANUALS

Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. List routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides in the maintenance manuals. Also include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

-- End of Section --

SECTION 12 21 00

WINDOW BLINDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2004) Fire Tests for Flame Propagation of Textiles and Films

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES

SD-03 Product Data

Window Blinds;
Hardware;
Installation

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Samples

Window Blinds;
Hardware;

Samples of each type and color of window treatment. Provide plastic vertical louvers 6 inch in length for each color. Track must be 6 inch in length. Shade material must be minimum 6 by 6 inch in size.

SD-06 Test Reports

Window Blinds

Fire resistance, Flame Spread, and smoke contribution data.

SD-08 Manufacturer's Instructions

Window Blinds;

SD-10 Operation and Maintenance Data

Window Blinds;

1.3 GENERAL REQUIREMENTS

Provide window treatment, conforming to NFPA 701, complete with necessary brackets, fittings, and hardware. Each window treatment type must be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Mount and operate equipment as per manufacturer's instructions. Windows to receive a treatment must be completely covered.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above 50 degrees F. Do not open containers until needed for installation unless verification inspection is required.

1.5 FIELD MEASUREMENTS

Become familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Provide each blind, including hardware, accessory items, mounting brackets and fastenings, as a complete unit produced by one manufacturer. All parts must be one color, unless otherwise indicated, to match the color of the blind slat. Treat steel features for corrosion resistance.

2.1.1 Vertical Blinds

Provide vertical blind units capable of nominally 180 degree partial tilting operation and full stackback. The blinds must be listed by the manufacturer as designed for heavy duty strength applications including heavy duty hardware. Provide vertical blinds to be wall mounted with inside brackets. Blinds must be sill length. Outside mount type installation must provide adequate overlap to control light and privacy.

2.1.1.1 Louvers

Provide louvers which are fire resistant solid vinyl, UV stable, and impact resistant; having a bottom chain. Louvers that are 3-1/2 inch must overlap not less than 3/8 inch.

2.1.1.2 Carriers

Provide carriers to support each louver. Provide carriers made of molded plastic to transverse on self-fabricated wheels for smooth, easy operation.

The hook of the carrier must have an automatic latch to permit easy installation and removal of the louver, and to securely lock the louver for tilting and traversing.

2.1.1.3 Headrail System

Provide headrail system not less than 0.047 inch thick and made of anodized aluminum alloy or 0.027 inch thick phosphate treated steel with a baked on ivory gloss enamel paint finish. The headrail must extend the full width of the blind and be closed with an end cap at each end. One cap must contain the traversing and tilting controls. The opposite cap will house the pulley for the traversing cord.

2.1.1.4 Valance

Attach the manufacturer's standard valance to the headrail by metal holders which grip the top and bottom edge of the valance and accept an insert of the same material as the slats. Provide sufficient clearance behind the valance to permit the louvers to tilt without interference. The headrail cover must extend the full width of the blind.

2.1.1.5 Controls

Provide tilting and traversing controls that hang compactly at the side of the blinds and reach within 40 inches of the floor. The tilt/traverse control must tilt all vanes simultaneously to any desired angle and hold them at that angle. Provide louvers that traverse one way to the right. The traversing control cord must be minimum 0.070 inch in diameter with a minimum breaking strength of 125 pounds. Anchor the cord to a lead carrier linked to all adjacent carriers. Provide louvers that traverse along the headrail by pulling one side of the looped cord a fiberglass wand that tilts the louvers by turning the wand and traverses the louvers by using the wand as a drapery control. Sliding glass doors must have a one way draw with stackback occurring opposite door openings.

2.1.1.6 Connectors and Spacers

The connector must be flexible, smooth and flat to slide unhindered when carriers move independently of each other, and to nest compactly when carriers are stacking. The length of the links must relate to the louver width in order to equally space the traversing louvers, to maintain uniform and adequate overlap of louvers, and to fully cover the width of the opening.

2.2 COLOR

Provide color, pattern and texture as indicated on the drawings selected from manufacturer's standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Vertical Blinds

Perform installation in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.1.2 Valance

Perform installation in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.2 CLEAN-UP

Upon completion of the installation, free window treatments from soiling, damage or blemishes; and adjust them for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Contracting Officer. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, must be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 0.75 inch or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

-- End of Section --

SECTION 12 36 00

COUNTERTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2009) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM D 4689	(1999; R 2005) Standard Specification for Adhesive, Casein-Type
ASTM D 4690	(1999; R 2005) Standard Specification for Urea Formaldehyde Resin Adhesives
ASTM F 594	(2009e1) Standard Specification for Stainless Steel Nuts
ASTM F 836M	(2002; R 2010) Standard Specification for Style 1 Stainless Steel Metric Nuts

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1	(2000) Performance & Construction Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION (SEFA)

SEFA 7	(1996) Recommended Practice for Laboratory and Hospital Service Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588	(Rev E; Notice 1) Bolt, Toggle: and Expansion Sleeve, Screw
FS FF-S-325	(Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS TT-C-490	(Rev E) Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings
FS TT-C-520	(Rev B; Notice 1) Coating Compound, Bituminous, Solvent Type, Underbody (for Motor Vehicles)
FS TT-F-336	(Rev E; Notice 2) Filler, Wood, Paste
FS WW-P-541	(Rev E; Am 1) Plumbing Fixtures

1.2 SUBMITTALS

Submitin accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Submit fabrication drawings for Countertop and Backsplash Fabrication, specified in this section.

SD-03 Product Data

Submit Manufacturer's catalog data for the following items:

Corrosion-Resistant Steel
Hardwood
Synthetic resin
Adhesives
Filler Material
Particle Board
Fasteners Steel
Sinks
Service Fixtures
Accessories and Hardware
Plastic Laminate

SD-04 Samples

Include samples for the following:

Countertop and Backsplash, one each, 4 inches in width, submitted as one unit or as separate items.

Accessories and Hardware, one each.

Submit Manufacturer's Standard Color Charts in accordance with paragraph entitled, "General," of this section.

SD-08 Manufacturer's Instructions

Submit Manufacturer's Instructions for in accordance with paragraph entitled, "General," of this section.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle countertops and backsplash in a manner that will prevent damage and disfigurement.

1.4 DESIGN

Provide factory fabricated, prefinished plastic laminate countertops in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Construct countertops as specified and meet the requirements of KCMA A161.1. Accomplish fastenings to permit removal and replacement of individual units without affecting the remainder of the installation. Provide counters with watertight sink rim when indicated. Include removable drawers equipped with position stops to avoid accidental complete withdrawals.

PART 2 PRODUCTS

2.1 GENERAL

Submit Manufacturer's Standard Color Charts for countertops showing the manufacturer's recommended color and finish selections.

Submit Manufacturer's Instructions for countertops including special provisions required to install equipment components and system packages. Include all special notices detailing impedances, hazards and safety precautions.

Provide the manufacturer's standard type countertops or as indicated on the drawings. Accomplish fastenings to permit removal and replacement of individual countertops without affecting the remainder of the installation.

2.2 MATERIALS

Provide Corrosion-Resistant Steel conforming to ASTM A1008/A1008M and ASTM A167, Type 304 Finish 4.

Use thermosetting urea-resin Type II Adhesives for application of plastic laminate conforming to ASTM D 4690 as recommended by the manufacturer of the laminate. Use adhesive for wood members conforming to ASTM D 4689.

Use Filler Material conforming to FS TT-F-336.
Provide Plastic Laminate conforming to ANSI/NEMA LD 3, Style as indicated on drawings.

Provide fasteners conforming to the following:

Screws: ASME B18.6.1, Group, Type and Class as applicable

Anchoring Devices: FS FF-S-325, Group, Type, and Class as applicable

Toggle bolts: FS FF-B-588, Type I, Class A, Style 2

Nuts: ASTM F 594, corrosion-resistant steel

Bolts: ASTM A325, heavy, hexagon head bolts corrosion-resistant steel

Nuts: ASTM F 836M, corrosion-resistant steel

Bolts: ASTM A325M, heavy, hexagon head bolts corrosion-resistant steel

Corrosion-resistant Steel Sinks:

18-gage corrosion-resistant steel, nonintegral, self-rimming

Drain holes in center of bowl

Underside coated with 1/8-inch thick sound deadener

Die-form, seamless, raised edges at front and ends

Cove corners to 1/2-inch radius

Equip with strainers and tail pieces

Sound deadening: conform to FS TT-C-520.

Provide Service Fixtures conforming to the following requirements:

Fixtures: In accordance with the water conservation policy as stated in the Standard Plumbing Codes, Appendix J.

Faucets: Splashback mounted, cast brass, chrome plated, FS WW-P-541

Faucets: Deck mounted, cast brass, chrome plated, FS WW-P-541

Drains, strainers, and taps: Brass, chrome plated, FS WW-P-541

Index buttons: Plastic, color codes in accordance with SEFA 7

Special items: Nipples and locknuts with each fixture will be as directed.

Metal pretreatment coatings: FS TT-C-490, Type I

2.3 COUNTERTOP AND BACKSPLASH FABRICATION

Construct countertops and backsplash of wood covered with a shop-applied plastic laminate.

Specify particle board with a minimum thickness of 3/4 inch. Build up edges and opening around sink rim with hardwood strips. Provide backsplash of similar construction, a minimum of 3/4-inch thick by the height indicated.

Provide continuous sheet laminate of the longest length practicable and of the design and color selected. Provide joints in the surface sheeting that are tight and flush, and held to a practical minimum number.

Edging and trim:

For plastic-laminate-covered countertops and backsplash, provide edging and trim consisting of:

Strips of laminate cut and fitted to exposed edges with contact adhesive

Provide sink rims which are the standard products of a manufacturer regularly producing this type of equipment, fabricated from corrosion-resistant steel of the size necessary to receive the sinks.

2.3.1 High-Pressure Laminated Plastic Clad Countertops

Construct clad countertop and backsplash of 3/4 inch thick, 44 pound density particle board core, post formed cove type or fully formed type. Provide single unit cove type unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash. Provide edging and trim that consists of plastic laminate cut and fitted to all exposed edges. Supply end splashes constructed of 3/4 inch plywood or 3/4 inch thick, 44 pound density particle board core. Provide continuous sheets of longest lengths practicable. Make all joints in surface sheeting tight and flush. When the countertop and backsplash are two separate units, use GP50 plastic laminate. When the countertop and backsplash are one unit, use PF42 plastic laminate. Provide plastic laminate conforming to the requirements of ANSI/NEMA LD 3, with contact type plastic laminate adhesive applied to both surfaces. For fully formed and cove type countertops, the post-forming plastic laminate can not be bent to a radius smaller than the limit recommended by the plastic manufacturer.

2.4 SURFACING

2.4.1 Laminated Plastic Surfacing

Laminate plastic sheeting to faces and exposed edges of particle board at 20 pounds per square inch and 185 degrees F.

Apply backing sheet to concealed faces.

2.4.2 Wood Countertop Finish

Provide factory applied HPDL finish as indicated on all internal and external surfaces.

2.4.2.1 HPDL Finish

Pattern and color: As selected from manufacturer's standard finishes As indicated.

2.5 ACCESSORIES AND HARDWARE

2.5.1 Mounting Adhesives

Provide structural-grade silicone or epoxy adhesives of type recommended by manufacturer for application and conditions of use.

Provide spacers, if required, of type recommended by adhesive manufacturer.

2.5.2 Joint Sealants

Use clear silicone sealant of type recommended by manufacturer for application and conditions of use.

Provide anti-bacterial type in food preparation areas.

2.5.3 Solvent

Use a product recommended by adhesive manufacturer to clean surface of quartz surfacing to assure adhesion of adhesives and sealants.

2.5.4 Cleaning Agents

Use non-abrasive, soft-scrub type kitchen cleaners.

2.6 COLOR, TEXTURE, AND PATTERN

Select color as indicated on the drawings. from manufacturers standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

Inspect material for defects prior to installation. Ensure materials throughout bear labels with the same batch number. Visually inspect materials used for adjacent pieces to assure acceptable color match. Inspect in lighting conditions similar to those on the project. Repair or replace damaged materials in a satisfactory manner.

Install countertops plumb with cabinetry level to within 1/16 inch in 10 feet. Level base cabinets by adjusting leveling screws. Scribe and fit scribe strips to irregularities of adjacent surfaces. Gap openings exceeding 0.025 inch are not acceptable.

Secure countertops to cabinetry and wall construction usingscrews, spaced 30 inches maximum on center.

3.1.1 Preliminary Installation and Adjustment

Install materials in accordance to manufacturer's recommendations. Lift and place to avoid breakage.

Position materials to verify that materials are correctly sized and prepared. Make necessary adjustments.

If jobsite cutting, grinding, or polishing is required, use water-cooled tools. Protect jobsite and surfaces against dust and water. Perform work away from installation site if possible.

3.1.2 Permanent Installation

After verifying fit, remove quartz surfacing from position, clean substrates of dust and contamination, and clean quartz surfacing back side and joints with solvent.

Apply sufficient quantity of mounting adhesive in accordance with adhesive manufacturer's recommendations to provide permanent, secure installation.

Spacing of mounting adhesive will not exceed:

Horizontal Surfaces: 16 inch on center

Vertical Surfaces: 8 inch on center; provide temporary shims until adhesive cures.

Install surfacing plumb, level, and square and flat to within 1/6 inch in 10 feet.

3.1.3 Joints

Joints between adjacent pieces of quartz surfacing:

Joints must be flush, tight fitting, level, and neat.

Securely join with stone adhesive. Fill joints level with quartz surfacing.

Clamp or brace quartz surfacing in position until adhesive sets.

Joints between backsplashes and countertops: Seal joints with silicone sealer.

3.2 CLEANING

On completion of cabinet installation, touch up marred or abraded finished surfaces. Remove crating and packing materials from premises. Wipe down surfaces to remove fingerprints and markings and leave in clean condition.

3.3 INSPECTION

Examine casework grounds and supports for adequate anchorage, foreign material, moisture, and unevenness that could prevent quality casework installation.

Ensure that electrical and plumbing rough-ins for casework are complete. Do not proceed with installation until defects are corrected.

-- End of Section --

SECTION 21 13 13.00 10

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.1	(2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250
ASME B16.11	(2009) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(2010) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2006) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	(2010) Standard for Square and Hex Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A135/A135M	(2009) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A449	(2010) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A795/A795M	(2008) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM F 436	(2011) Hardened Steel Washers

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2010; Errata 10-1; TIA 10-1; TIA 11-2) Standard for the Installation of Sprinkler Systems
NFPA 1963	(2009; Errata 09-1) Standard for Fire Hose Connections
NFPA 20	(2010; TIA 10-1) Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	(2010) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2011) Building Materials Directory
UL Fire Prot Dir	(2011) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Furnish piping offsets, fittings, and any other accessories as required to provide a complete installation and to eliminate interference with other construction. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage. Provide wet pipe sprinkler system in all areas of the building. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Rack sprinklers shall be in accordance with NFPA 13. Design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the

sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

Hydraulically design the system to discharge a minimum density as shown on the drawings. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 20 ft/s.

1.2.1.1 Hose Demand

Add an allowance for exterior hose streams, as indicated on the drawings, to the sprinkler system demand at the point of connection to the existing system.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 55 psi, and a flow of 1300 gpm at a residual pressure of 28 psi based on a flow test conducted by Poole Fire Protection 9.11.11. The design shall also incorporate the use of a fire pump as specified in 21 30 00 FIRE PUMPS. Water supply shall be presumed available at the connection to the underground. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping. Hydraulic calculations shall be based on operation of the fire pump(s) provided in Section 21 30 00 FIRE PUMPS

1.2.1.3 Hydraulic Calculations

Submit hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments and as outlined in NFPA 13, except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings to substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13, but shall not exceed 100 square feet for extra hazard occupancies, 130 square feet for ordinary hazard occupancies, and 225 square feet for light hazard occupancies.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;
As-Built Drawings

SD-03 Product Data

Fire Protection Related Submittals
Materials and Equipment;
Spare Parts
Preliminary Tests;
Final Acceptance Test;
Onsite Training;
Fire Protection Specialist;
Sprinkler System Installer;

SD-05 Design Data

Hydraulic Calculations;

SD-06 Test Reports

Preliminary Test Report;
Final Acceptance Test Report;

SD-07 Certificates

Inspection by Fire Protection Specialist;

SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals

1.4 QUALITY ASSURANCE

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall

govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.4.1 Fire Protection Specialist

All required shop drawings, calculations, materials, qualifications, test procedures, and test reports shall be submitted to and approved by the Fire Protection Specialist. All final system acceptance testing shall be witnessed and approved by the Fire Protection Specialist. Submit the name and documentation of certification of the proposed Fire Protection Specialists prior to the submittal of the sprinkler system drawings and hydraulic calculations. The Fire Protection Specialist shall prepare and submit a list of the fire protection related submittals. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. The Fire Protection Specialist shall be a registered fire protection engineer in the State of Georgia.

1.4.2 Sprinkler System Installer

Work specified in this section shall be performed by the Sprinkler System Installer who is regularly engaged in the installation of the type and complexity of system specified in the contract documents, and who has served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. Submit the name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

1.4.3 Shop Drawings

Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Submit 3 copies of the Sprinkler System shop drawings, no later than 21 days prior to the start of sprinkler system installation. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall

show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. Submit load calculations for sizing of sway bracing, for systems that are required to be protected against damage from earthquakes.

1.5 DELIVERY, STORAGE, AND HANDLING

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.6 NOT USED

PART 2PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Provide Materials and Equipment that have been tested by Underwriters Laboratories, Inc. and are listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM APP GUIDE. Submit manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, provide a complete equipment list that includes equipment description, model number and quantity.

2.4 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

2.4.1 Steel Piping Components

2.4.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black for piping in interior spaces and galvanized for exterior spaces as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A795/A795M, ASTM A53/A53M, or ASTM A135/A135M. Pipe in which threads or grooves are cut or rolled formed shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut or rolled formed. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.4.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.4.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer;segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A47/A47M, Grade 32510; ductile iron conforming to ASTM A536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.

2.4.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type.

2.4.1.5 Bolts, Nut, and Washers

Bolts shall be conform to ASTM A449, Type 1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts, or as specified by the fitting manufacturer.

2.4.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM APP GUIDE and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.4.3 Valves

2.4.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type unless otherwise indicated on the design drawings. All control valves shall be listed in UL Bld Mat Dir or FM APP GUIDE.

2.4.3.2 Check Valve

Check valve 2 inches and larger shall be listed in UL Bld Mat Dir or FM APP GUIDE. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.5 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

2.6 ALARM INITIATING AND SUPERVISORY DEVICES

2.6.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.6.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.7 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. If used, female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963. Contractor shall coordinate fire department connection specifications with the owner.

2.8 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be ordinary unless otherwise required by NFPA 13. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used unless otherwise indicated.

2.8.1 Concealed Sprinkler

Concealed sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.8.2 Recessed Sprinkler

Recessed sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice. Recessed sprinkler shall be provided in the MSD portion of the building.

2.8.3 Flush Sprinkler

Flush sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.8.4 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, quick-response type (where permitted by NFPA 13) with nominal 1/2 inchor 17/32 inch orifice. Pendent sprinklers shall have a polished chrome finish.

2.8.5 Upright Sprinkler

Upright sprinkler shall be chrome-plated and shall have a nominal 1/2 inch or 17/32 inch orifice. Upright sprinklers shall be quick response where permitted by NFPA 13.

2.8.6 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.

2.8.7 Corrosion Resistant Sprinkler

Corrosion resistant sprinkler shall be the upright or pendent type installed in corrosive environments. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.

2.8.8 Dry Sprinkler Assembly

Dry sprinkler assembly shall be of the sidewall, type and listed for extended coverage use in ordinary hazard occupancies. Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in UL Fire Prot Dir. Sprinklers shall have a polished chrome finish.

2.9 ACCESSORIES

2.9.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.9.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.9.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.9.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers susceptible to mechanical damage. Examples include, but are not limited to, mechanical rooms, elevator pits, high traffic areas, and other areas subject to mechanical impact.

2.9.5 Identification Sign

Valve identification sign shall be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

A hydraulic data placard shall be located at each riser. The placard shall be a permanently marked, weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire or chain. The placard shall contain the following information:

a. Location of design area or areas

b. Discharge densities over the design area or areas

c. Required flow and residual pressure demand at the base of the riser

d. Occupancy classification or commodity classification and maximum permitted storage heigh and configuration

e. Hose stream allowance included in addition to the sprinkler demand

f. The name of the installing contractor

PART 3 EXECUTION

3.1 FIELD MEASUREMENTS

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 13.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

Prior to ceiling installation and concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports. The Fire Protection Specialist shall: 1) inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements, 2) witness the preliminary and final tests, and sign the test results, 3) after completion of the system inspections and a successful final test, certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

Seismically protect the system piping against damage from earthquakes in accordance with NFPA 13.

3.4.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide a minimum headroom of 7'-6".

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches for steel pipe or 6 inches for copper tubing. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the

reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area. Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation.

Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07 84 00 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected at the riser as a combination test and drain valve; a test valve located a maximum of 6 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. All other drain piping shall be piped outside of the building unless otherwise indicated in the design documents. Auxiliary drains shall be provided as required by NFPA 13 and the design documents.

3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade and as shown on the drawings. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Wiring color code shall remain uniform throughout the system.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.7 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. Submit proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests and proposed date and time to begin the preliminary tests. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, submit 3 copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Tests. The Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

3.7.1 Underground Piping

3.7.1.1 Flushing

Existing underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system.

3.7.2 Aboveground Piping

3.7.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.7.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. Provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, pitot tube gauge, plus all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. Provide a metal placard on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.7.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.7.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.8 FINAL ACCEPTANCE TEST

Begin the Final Acceptance Test only when the Preliminary Test Report has been approved. Submit proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests, and proposed date and time to begin the Test, submitted with the procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Submit as-built shop drawings, at least 14 days after completion of the Final Tests, updated to reflect as-built conditions after all related work is completed. Drawings shall be in electronic format. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. Submit 2 copies of the completed Final Acceptance Test Report no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

3.9 ONSITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 1010	(2002) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4	(1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)
ASSE 1010	(2004) Performance Requirements for Water Hammer Arresters (ANSI approved 2004)
ASSE 1018	(2001) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002
ASSE 1019	(2011) Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type (ANSI Approved 2004)
ASSE 1037	(1990) Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites

AWWA B301	(2010) Liquid Chlorine
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(2011) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C652	(2011) Disinfection of Water-Storage Facilities

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2011) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.2/B2.2M	(2010) Specification for Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.14.1	(2003; R 2008) Backwater Valves
ASME A112.19.2/CSA B45.1	(2008; Update 1 2009; Update 2 2011) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
ASME A112.19.3/CSA B45.4	(2008; Update 1 2009; Update 2 2011) Stainless Steel Plumbing Fixtures
ASME A112.36.2M	(1991; R 2008) Cleanouts
ASME A112.6.1M	(1997; R 2008) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2001; R 2007) Standard for Floor and Trench Drains
ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B16.12	(2009) Cast Iron Threaded Drainage Fittings
ASME B16.15	(2011) Cast Bronze Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22	(2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2007) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.50	(2001; R 2008) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME B31.1	(2010) Power Piping
ASME B31.5	(2010) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2010) BPVC Section IV-Rules for Construction of Heating Boilers
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME CSD-1	(2009) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2011) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts

ASTM A193/A193M	(2011) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A515/A515M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A518/A518M	(1999; R 2008) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A733	(2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A74	(2009) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A888	(2011) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B152/B152M	(2009) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B306	(2009) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes

ASTM B43	(2009) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B584	(2011) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B75	(2002; R 2010) Standard Specification for Seamless Copper Tube
ASTM B813	(2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B828	(2002; R 2010) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2005; R 2011) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C1053	(2000; R 2010) Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C564	(2011) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2235	(2004; R 2011) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2239	(2003) Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2004; R 2009e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2661	(2011) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40, Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2665	(2011) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2672	(1996a; R 2009) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D2683	(2010) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2737	(2003) Polyethylene (PE) Plastic Tubing
ASTM D2822/D2822M	(2005e1; R 2011) Asphalt Roof Cement
ASTM D2846/D2846M	(2009be1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2855	(1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D2996	(2001; R 2007e1) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3035	(2010) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3122	(1995; R 2009) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D3138	(2004; R 2011) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3261	(2010a) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM E1	(2007) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM F 1760	(2001; R 2011) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 2389	(2010) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
ASTM F 409	(2002; R 2008) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(2009) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(2009) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(2011) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(2010) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2008) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core

ASTM F 877	(2011a) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F 891	(2010) Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2009) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(1994; R 1995) Copper Tube Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO PS 117	(2005b) Press Type Or Plain End Rub Gasketed W/ Nail CU & CU Alloy Fittings 4 Install On CU Tubing

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(2009) International Plumbing Code
ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(2010; Errata 2011) Steel Pipeline Flanges
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2002a) Butterfly Valves
MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MSS SP-70	(2006) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(2010) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(2005a) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2006) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-85	(2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE SP0169	(1992; R 2007) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2009) Motors and Generators
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF/ANSI 14	(2011a) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2011) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2010) Firestopping: Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(2010) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508 (2009) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SM 9223 (2004) Enzyme Substrate Coliform Test

PL 93-523 (1974; A 1999) Safe Drinking Water Act

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED (2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 141.80 National Primary Drinking Water Regulations; Control of Lead and Copper; General Requirements

PL 109-58 Energy Policy Act of 2005 (EPAct05)

UNDERWRITERS LABORATORIES (UL)

UL 1951 (2011) Electric Plumbing Accessories

UL 499 (2005; Reprint Mar 2011) Electric Heating Appliances

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 - SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System;

Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-03 Product Data

Fixtures

Flush valve water closets

Flush valve urinals

Wall hung lavatories

Kitchen sinks

Utility sinks

Floor sinks

Drinking-water coolers

Water heaters

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies;

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests.

SD-10 Operation and Maintenance Data

Plumbing System

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000

hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.3 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.4 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.3.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - IP

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system.

1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. PVC pipe shall contain a minimum of 25 percent recycled content in accordance with ASTM F 1760. HDPE pipe shall contain a minimum of 100 percent post-consumer recycled content. Steel pipe shall contain a minimum of 25 percent recycled content, with a minimum of 16 percent post-consumer recycled content. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F 2389. Polypropylene piping

that will be exposed to UV light shall be provided with a Factory applied UV resistant coating. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310

b. Coupling for Steel Pipe: AWWA C606.

c. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12).

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

g. Solder Material: Solder metal shall conform to ASTM B32.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.

k. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 230 degrees F.

l. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F 477.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138.

o. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D2235.

p. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.

q. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

r. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

s. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D3122.

t. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

u. Copper tubing shall conform to ASTM B88, Type K, L or M.

v. Heat-fusion joints for polypropylene piping: ASTM F 2389.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201. Water hammer arrester shall be piston type.

b. Copper, Sheet and Strip for Building Construction: ASTM B370.

c. Asphalt Roof Cement: ASTM D2822/D2822M.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

l. Thermometers: ASTM E1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110

Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Wall Hydrants (Frostproof)

ASSE 1019 with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

2.3.4 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve.The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets.The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.5 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1. Vitreous China, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with

appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains shall be copper alloy with all visible surfaces chrome plated. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature.

2.4.1 Automatic Controls

Provide automatic, sensor operated faucets and flush valves to comply with ASSE 1037 and UL 1951 for lavatory faucets, urinals, and water closets. Flushing and faucet systems shall consist of solenoid-activated valves with light beam sensors. Flush valve for water closet shall include an override pushbutton. Flushing devices shall be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

2.4.2 Flush Valve Water Closets

ASME A112.19.2/CSA B45.1, white vitreous china, siphon jet, elongated bowl, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 14 to 15 inches, except 17 to 19 inches for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Provide white solid plastic elongated open-front seat.

Water flushing volume of the water closet and flush valve combination shall not exceed1.28 gallons per flush.

Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Mounted height of flush valve shall not interfere with the hand rail in ADA stalls. Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.

2.4.3 Flush Valve Urinals

ASME A112.19.2/CSA B45.1, white vitreous china, wall-mounted, wall outlet, siphon jet, integral trap, and extended side shields. Provide urinal with the rim 17 inches above the floor. Water flushing volume of the urinal and flush valve combination shall not exceed 0.125 gallons per flush. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.

2.4.4 Wall Hung Lavatories

ASME A112.19.2/CSA B45.1, white vitreous china, straight back type, minimum dimensions of 19 inches, wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory. Mount lavatory with the front rim 34 inches above floor and with 29 inches minimum clearance from bottom of the front rim to floor. Provide top mounted washerless centerset lavatory faucets. Provide top-mounted solenoid-activated lavatory faucets including electrical-operated light-beam-sensor to energize the solenoid.

2.4.5 Kitchen Sinks

ASME A112.19.3/CSA B45.4, 20 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of 33 inches wide by 21 inches front to rear, two compartments, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 3.5 inch drain outlet. Provide aerator with faucet. Water flow rate shall not exceed 1.0 gpm when measured at a flowing water pressure of 60 psi. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 1.5 inch P-trap and drain piping to vertical vent piping from each compartment. Provide top mounted washerless sink faucets with hose spray.

2.4.6 Utility Sinks

ASME A112.19.2/CSA B45.1, white vitreous china with integral back and wall hanger supports, minimum dimensions of 22 inches wide by 20 inches front to rear, with two supply openings in 10 inch high back. Provide floor supported wall outlet cast iron P-trap and stainless steel rim guards as recommended by service sink manufacturer. Provide back mounted washerless service sink faucets with vacuum breaker and 0.75 inch external hose threads.

2.4.7 Drinking-Water Coolers

AHRI 1010 with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bubbler style, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor and basin, and stainless steel cabinet. Bubblers shall be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts shall be mounted at maximum of 36 inches above floor and at front of unit basin. Spouts shall direct water flow at least 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit. Provide ASME A112.6.1M concealed steel pipe chair carriers.

2.4.8 Wheelchair Drinking Water cooler

AHRI 1010, wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with 27 inch minimum knee clearance from front bottom of unit to floor and 36 inch maximum spout height above floor. Bubblers shall also be controlled by push levers, by

push bars, or touch pads one on each side or one on front and both sides of the cabinet.

2.5 DRAINS

2.5.1 Floor Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping. Primer shall meet ASSE 1018.

2.5.1.1 Drains and Backwater Valves

Drains and backwater valves installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.5.2 Floor Sinks

Floor sinks shall be square, with 12 inch nominal overall width or diameter and 10 inch nominal overall depth. Floor sink shall have an acid-resistant enamel interior finish with cast-iron body, aluminum sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size shall be as indicated or of the same size as the connecting pipe.

2.6 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The

assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.7 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 200 degrees F water temperature and 150 psi working pressure. The expansion tank size and acceptance volume shall be sized by the manufacturer.

2.7.1 Electric Instantaneous Water Heaters (Tankless)

UL 499 and UL listed flow switch activated, tankless electric instantaneous water heater for wall mounting below sink or lavatory.

2.8 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.9 MISCELLANEOUS PIPING ITEMS

2.9.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.9.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

2.9.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.9.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.9.3 Pipe Hangers (Supports)

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.9.4 Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using

crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.6 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise

location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Rigid grooved pipe couplings shall be for use with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 125 psi service and appropriate for static head plus the pumping head, and shall provide a watertight joint.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.1.2.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.2.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.6 Copper Tube and Pipe

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper- phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.

c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

d. Press connection. Copper press connections shall be made in **strict** accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer **of that joint**. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

3.1.2.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.2.8 Polypropylene Pipe

Joints for polypropylene pipe and fittings shall be made by heat fusion welding socket-type or butt-fusion type fittings and shall comply with ASTM F 2389.

3.1.2.9 Other Joint Methods

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be in accordance with industry standard. Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt

around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs,

flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve.The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.5.6 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.7.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 4 inches.

(2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in

determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 4 inches and larger carrying medium less that 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.7.3 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged

branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair

carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.4.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.4.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.4.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified inDIVISION 05 - METALS.

3.4 IDENTIFICATION SYSTEMS

3.4.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.4.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in DIVISION 09 - FINISHES.

3.4.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as directed by the Contracting Officer.

3.5 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.6 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in DIVISION 09 - FINISHES.

3.6.1 Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.6.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.6.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

3.7 TESTS, FLUSHING AND DISINFECTION

3.7.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.7.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.7.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.7.3 System Flushing

3.7.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with hot potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

3.7.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced.After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.7.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Temperature of each domestic hot-water supply.

f. Operation of each floor and roof drain by flooding with water.

g. Operation of each vacuum breaker and backflow preventer.

h. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

3.7.5 Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take addition samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with EPA SM 9223. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.8 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

3.9 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.10 TABLES

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X	

3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A536 And ASTM A47/A47M	X	X		X	X	
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M for use with Item 5	X	X		X	X	
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 5	X	X		X	X	
8	Wrought copper grooved joint pressure pressure fittings for non-ferrous pipe ASTM B75M ASTM B75 C12200, ASTM B152/B152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X				
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
10	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S, Grade B	X			X	X	

11	Seamless red brass pipe, ASTM B43				X	X	
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
13	Cast copper alloy solder joint pressure fittings, ASME B16.18for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B42						X
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D2661, ASTM F 628	X	X	X	X	X	X
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X	X	X
21	Process glass pipe and fittings, ASTM C1053						X

22	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A518/A518M		X			X	X
23	Polypropylene (PP) waste pipe and fittings, ASTM D4101						X
24	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D2996						X

SERVICE:
- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- * - Hard Temper

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	
4	Steel pipe:				

	a. Seamless, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings groovedjoint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter	X			X
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D3035	X			X

15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441/F 441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442/F 442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F 437, for use with Items 20, and 21	X	X		X
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 20, 21, and 22	X	X		X

25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D1785	X			X
26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2467 for use with Items 26 and 27	X			X
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2464	X			X
30	Joints for IPS PVC pipe using solvent cement, ASTM D2672	X			X
31	Polypropylene (PP) plastic pipe and fittings; ASTM F 2389	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F 877	X	X		X

38	Press Fittings: A - Cold Water Service Aboveground B - Hot and Cold Water Distribution 82 degrees C 180 degrees F Maximum Aboveground C - Compressed Air Lubricated D - Cold Water Service Belowground Indicated types are minimum wall thicknesses. ** - Type L - Hard *** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors **** - In or under slab floors only brazed joints

-- End of Section --

SECTION 22 07 19.00 40

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 209	(2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1136	(2006) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 195	(2000) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C 553	(2002) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 795	(2003) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(2003a) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 579	(2004) Standard Specification for Greige Woven Glass Fabrics
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 96/E 96M	(2005) Standard Test Methods for Water Vapor Transmission of Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(2006) Standard on Types of Building Construction
NFPA 255	(2005; Errata 2006) Standard Method of Test of Surface Burning Characteristics of Building Materials

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3779	(1990; Rev A; R 1994) Tape Adhesive, Pressure Sensitive Thermal Radiation Resistant, Aluminum Foil/Glass Cloth

1.2 SYSTEM DESCRIPTION

Section 23 00 00.00 40 HEATING, VENTILATING, AND AIR-CONDITIONING applies to work specified in this section.

1.3 PERFORMANCE REQUIREMENTS

Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, shall have a flame-spread classification (FSC) of 25, and a smoke-developed classification (SDC) of 50. These maximum values shall be determined in accordance with ASTM E 84 or NFPA 255. Coatings and sealants shall be nonflammable in their wet state.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Adhesives
Coatings
Insulation Materials
Jacketing

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry

state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 Cloth Adhesives

Adhesives for adhering, sizing, and finishing lagging cloth, canvas, and open-weave glass cloth shall be a pigmented polyvinyl acetate emulsion and shall conform to the requirements of ASTM C 916, Type I.

2.1.1.2 Vapor-Barrier Material Adhesives

Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be solvent-base, synthetic-rubber type and shall conform to the requirements of ASTM C 916, Type I, for attaching fibrous-glass insulation to metal surfaces. Solvent shall be nonflammable.

2.1.1.3 Cellular Elastomer Insulation Adhesive

Adhesive for cellular elastomer insulation shall be a solvent cutback chloroprene elastomer conforming to ASTM C 916, Type I, and shall be of a type approved by the manufacturer of the cellular elastomer for the intended use.

2.1.2 Coatings

2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be a nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to the requirements of ASTM C 1136 and ASTM C 921.

2.1.2.2 Indoor Vapor-Barrier Finishing

Coatings for indoor vapor-barrier finishing of insulation surfaces shall be a pigmented resin and solvent compound and shall conform to ASTM C 1136, Type II.

2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer-emulsion type recommended by the insulation material manufacturer for the surface to be coated and shall be applied to specified dry-film thickness.

2.1.2.4 Cellular-Elastomer Insulation Coating

Finish coating for cellular-elastomer insulation shall be a polyvinylchloride lacquer approved by the manufacturer of the cellular elastomer.

2.1.2.5 Coating Color

Coating color shall be as specified by the Contracting Officer's Technical Representative.

2.1.3 Insulating Cement

2.1.3.1 General Purpose Insulating Cement

General purpose insulating cement shall be mineral fiber and shall conform to ASTM C 195. Composite shall be rated for 1800 degrees F service and shall have a thermal-conductivity maximum of 0.85<MET> [_____] watt per meter per degree Kelvin</MET> Btu by inch per hour per square foot for each degree F temperature differential at 200 degrees F mean temperature for 1 inch thickness.

2.1.3.2 Finishing Insulating Cement

Finishing insulating cement shall be mineral-fiber, hydraulic-setting type conforming to ASTM C 449/C 449M.

2.1.4 Calking

Calking used with specified insulation materials shall be an elastomeric joint sealant in accordance with ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.5 Corner Angles

Corner angle piping insulation shall be nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be in accordance with ASTM B 209, Alloy 3105.

2.1.6 Insulation Materials

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

2.1.6.1 Mineral Fiber

Mineral fiber shall conform to ASTM C 553,
shall be suitable for surface temperatures up to 370 degrees F, and shall be of not less than 4-pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot square per degree F at 150 degrees F mean.

2.1.6.2 Pipe Barrel

Pipe barrel insulation shall be Type II, Molded, Grade A or Type III, Precision V-Groove, Grade A for use at temperatures up to and including 1200 degrees F.

2.1.6.3 Pipe Fittings

Pipe fitting insulation shall be molded pipe fitting covering for use at temperatures up to and including 1200 degrees F.

2.1.6.4 Flexible Blankets

Flexible blankets shall be blankets and felts for use at temperatures up to and including 350 degrees F minimum 1 pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot per degree F at 75 degrees F mean.

2.1.6.5 Cellular Glass

Cellular glass shall conform to ASTM C 552, Type II, Grade 2, pipe covering. Substitutions for this material shall not be permitted. Minimum thickness shall be 1-1/2 inches

2.1.7 Jacketing

2.1.7.1 Glass Cloth Jackets

Glass cloth shall be plain-weave glass cloth conforming to ASTM D 579, Style 141 and shall weigh not less than 7.23 ounces per square yard before sizing. Cloth shall be factory applied wherever possible.

Glass reinforcing cloth shall be a leno weave, 26-end and 12-pick thread conservation, with a warp and fill tensile strength of 45 and 30 pounds per inch of width, respectively, and with a weight of not less than 1.5 ounces per square yard.

2.1.7.2 PVC Jackets

Polyvinylchloride (PVC) shall be a 0.010 inch thick, factory-premolded, pipe-barrel sheeting vapor-barrier jacketing. Material shall be self-extinguishing, high-impact strength, moderate chemical resistance. Permeability rating shall be 0.01 grain per hour per square foot per inch of mercury pressure difference, determined in accordance with ASTM E 96/E 96M. Vapor-barrier joint adhesive shall be the manufacturer's standard solvent-weld type.

Vapor barrier shall conform to ASTM C 1136, Type I, low-vapor transmission, high-puncture resistance for use on insulation for piping, ducts, and equipment.

2.1.7.3 3-Ply Laminate

Jacketing shall be a 3-ply laminate of 35-pound per 100 square foot white-bleached kraft, bonded to not less than 0.0007 inch thick aluminum foil and reinforced with glass fiber.

Water-vapor permeance rating of the composite shall be 0.02 perm or grain per hour per square foot, per inch of mercury pressure differential, determined in accordance with ASTM E 96/E 96M.

2.1.8 Tape

Glass lagging shall be a knitted elastic cloth specifically suitable for continuous spiral wrapping of insulated pipe bends and fittings and shall produce a smooth, tight, wrinkle-free surface. Tape shall conform to

requirements of SAE AMS 3779, SAE AMS 3779, ASTM D 579, and ASTM C 921, and shall weigh not less than 10 ounces per square yard.

2.2 PIPING SYSTEMS

Insulation thickness and pipe sizes are in inches. Pipe size is inclusive dimensionally, and includes pipe nominal pipe size (NPS) and tubing outside diameter.

2.2.1 Cold-Water and Condensate-Drain Piping

Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated

Insulation shall be 3/8 inch mineral fiber with glass cloth jacket, Type T-2.

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Joints shall be tight with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed, or finished as specified. Longitudinal seams of exposed insulation shall be directed away from normal view.

Materials shall be applied in conformance with the recommendations of the manufacturer.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

Installation Drawings for pipe insulation shall be in accordance with the adhesive manufacturer's written instructions for installation.

3.2 SYSTEM TYPES

3.2.1 Type T-1, Mineral Fiber with Vapor-Barrier Jacket

Piping shall be covered with mineral-fiber pipe insulation with factory-and field-attached vapor-barrier jacket. Vapor seal shall be maintained. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than 1-1/2 inches. Jacketing bands for butt joints shall be 3 inches wide.

Exposed-to-view fittings and valve bodies shall be covered with preformed mineral-fiber pipe-fitting insulation of the same thickness as the pipe-barrel insulation. Fitting insulation shall be temporarily secured in place

with light cord ties.A 60-mil coating of white indoor vapor-barrier coating shall be applied and, while still wet, wrapped with glass lagging tape with 50 percent overlap, and shall be smoothly blended into the adjacent jacketing. Additional coating shall be applied as needed and rubber-gloved to smooth fillet or contour coating, then allowed to fully cure before the finish coating is applied. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a special mastic consisting of a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Where standard vapor-barrier jacketing cannot be used, the surfaces shall be made vapor tight by using coating and glass lagging cloth or tape as previously specified.

In lieu of materials and methods previously specified, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. Seams shall be made vapor tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. All jacket ends shall be held in place with AISI 300 series corrosion-resistant steel straps, 15 mils thick by 1/2 inch wide.

Pipe insulation shall be set into an outdoor vapor-barrier coating for a minimum of 6 inches at maximum 12-foot spacing and the ends of the insulation sealed to the jacketing with the same material to provide an effective vapor-barrier stop.

Staples shall not be used in applying insulation. Vapor-barrier materials shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealments.

Piping insulation at hangers shall consist of 13-pounds per cubic foot density, fibrous-glass inserts or expanded, rigid, closed-cell, polyvinylchloride. Junctions shall be sealed with vapor-barrier jacket where required, glass-cloth mesh tape, and vapor-barrier coating.

White-bleached kraft paper side of the jacketing shall be on the side exposed to view.

Exposed-to-view insulation shall be finished with not less than a 6-mil dry-film thickness of nonvapor-barrier coating suitable for painting.

3.2.2 Type T-10, Mineral-Fiber Fill

Voids surrounding pipe shall be packed with mineral-fiber fill.

-- End of Section --

SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 201	(2002; R 2011) Fans and Systems
AMCA 210	(2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(2008) Reverberant Room Method for Sound Testing of Fans
AMCA 301	(2006; INT 2007; Errata 2008) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 260	(2001) Sound Rating of Ducted Air Moving and Conditioning Equipment
AHRI 350	(2008) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
AHRI 410	(2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI 430	(2009) Central-Station Air-Handling Units
AHRI 440	(2008) Room Fan-Coils and Unit Ventilators
AHRI 880	(2011) Performance Rating of Air Terminals
AHRI 885	(2011) Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
AHRI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11	(1990; R 2008) Load Ratings and Fatigue Life for Roller Bearings
ABMA 9	(1990; R 2008) Load Ratings and Fatigue Life for Ball Bearings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.2	(2007; Addenda B 2008; Errata 2009, Errata 2010; INT 2010; Errata 2011) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 62.1	(2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality
ASHRAE 68	(1997) Laboratory Method of Testing to Determine the Sound Power In a Duct
ASHRAE 70	(2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B766	(1986; R 2008) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C1071	(2005e1) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

ASTM C553	(2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM D1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D3359	(2009e2) Measuring Adhesion by Tape Test
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM E2016	(2006) Standard Specification for Industrial Woven Wire Cloth
ASTM E84	(2011b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F 1040	(1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2009) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code
NFPA 701	(2010) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1819	(2002) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 5th Edition
SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82	Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 181	(2005; Reprint Oct 2008) Factory-Made Air Ducts and Air Connectors
UL 1995	(2011) Heating and Cooling Equipment
UL 555	(2006; Reprint Sep 2011) Standard for Fire Dampers
UL 555S	(1999; Reprint May 2011) Smoke Dampers
UL 586	(2009) Standard for High-Efficiency Particulate, Air Filter Units
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 705	(2004; Reprint Apr 2011) Standard for Power Ventilators
UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
UL 900	(2004; Reprint Nov 2009) Standard for Air Filter Units
UL 94	(1996; Reprint Oct 2010) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL Bld Mat Dir	(2011) Building Materials Directory
UL Electrical Construction	(2011) Electrical Construction Equipment Directory
UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

1.2.1 Mechanical Equipment Identification

The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms. Where more than one chart or diagram per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.2.1.1 Charts

Provide chart listing of equipment by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics.

1.2.1.2 Diagrams

Submit proposed diagrams, at least 2 weeks prior to start of related testing. provide neat mechanical drawings provided with extruded aluminum frame under 1/8-inch glass or laminated plastic, system diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system. After approval, post these items where directed.

1.2.2 Service Labeling

Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation.

1.2.3 Color Coding

Color coding of all piping systems shall be in accordance with ASME A13.1.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Metallic Flexible Duct
Insulated Nonmetallic Flexible Duct Runouts
Duct Connectors
Duct Access Doors
Fire Dampers
Manual Balancing Dampers
Automatic Smoke Dampers
Diffusers
Registers and Grilles
Louvers
In-Line Centrifugal Fans
Sidewall Propeller Type Fans
Centrifugal Type Power Roof Ventilators
Air Handling Units
Room Fan-Coil Units
Variable Volume, Single Duct Terminal Units
Test Procedures
Diagrams

SD-06 Test Reports

Performance Tests

SD-07 Certificates

None

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions
Operation and Maintenance Training

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Fire Dampers
Automatic Smoke Dampers
In-Line Centrifugal Fan
Sidewall Propeller Type Fans
Centrifugal Type Power Roof Ventilators
Air Handling Units
Room Fan-Coil Units
Variable Volume, Single Duct Terminal Units

1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.

c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or

treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations. Provide written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. Include illustrations of product markings, and the number of each type of bolt to be furnished in the certification.

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 Ozone Depleting Substances Used as Refrigerants

Minimize releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F.

1.4.4 Use of Ozone Depleting Substances, Other than Refrigerants

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

a. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon

b. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays.

c. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial cabling.

d. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

1.4.5 Detail Drawings

Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of

the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

1.4.6 Test Procedures

Submit proposed test procedures and test schedules for the ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

2.2 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

2.3 ELECTRICAL WORK

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00INTERIOR DISTRIBUTION SYSTEM. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.

c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system , and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.

d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

e. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers are allowed to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and adjustable frequency drives for larger motors.

2.4 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

2.5 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

2.6 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

2.7 DUCT SYSTEMS

2.7.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification.

a. Ductwork shall be constructed meeting the requirements for the duct system static pressure specified in APPENDIX D of Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

b. Provide ductwork that meets the requirements of Seal Class A. Provide ductwork in VAV systems upstream of the VAV boxes that meets the requirements of Seal Class A.

c. Provide sealants that conform to fire hazard classification specified in DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.

2.7.1.1 Metallic Flexible Duct

a. Provide duct that conforms to UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Provide duct assembly that does not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of two inches water gauge positive and 1.5 inches water gauge negative. Provide flexible round duct length that does not exceed five feet. Secure connections by applying adhesive for two inches over rigid duct, apply flexible duct two inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.

b. Inner duct core: Provide interlocking spiral or helically corrugated flexible core constructed of zinc-coated steel, aluminum, or stainless steel; or constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.

c. Insulation: Provide inner duct core that is insulated with mineral fiber blanket type flexible insulation, minimum of one inch thick. Provide insulation covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

2.7.1.2 Insulated Nonmetallic Flexible Duct Runouts

Use flexible duct runouts only where indicated.Runout length is indicated on the drawings, and is not to exceed 5 feet. Provide runouts that are preinsulated, factory fabricated, and that comply with NFPA 90A and UL 181. Provide either field or factory applied vapor barrier. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts.Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

2.7.1.3 General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector

system that complies with NFPA 701 and is classified as "flame-retardent fabrics" in UL Bld Mat Dir.

2.7.2 Duct Access Doors

Provide hinged access doors conforming to SMACNA 1966 in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 15 by 18 inches, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 24 by 24 inches or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

2.7.3 Fire Dampers

Use 1.5 hour rated fire dampers unless otherwise indicated. Provide fire dampers that conform to the requirements of NFPA 90A and UL 555. Perform the fire damper test as outlined in NFPA 90A. Provide a pressure relief door upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then provide a factory installed pressure relief damper. Provide automatic operating fire dampers with a dynamic rating suitable for the maximum air velocity and pressure differential to which it is subjected. Provide fire dampers approved for the specific application, and install according to their listing. Equip fire dampers with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, does not impair the operation of the damper. Equip sleeves or frames with perimeter mounting angles attached on both sides of the wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies in conformance with UL Fire Resistance. Provide curtain type with damper blades out of the air stream or single blade type or multi-blade type fire dampers. Install dampers that do not reduce the duct or the air transfer opening cross-sectional area. Install dampers so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, comply with the installation details given in SMACNA 1819 and in manufacturer's instructions for fire dampers. Perform acceptance testing of fire dampers according to paragraph Fire Damper Acceptance Test and NFPA 90A.

2.7.4 Manual Balancing Dampers

a. Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators.

b. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide access doors or panels in hard ceilings, partitions and walls for access to all concealed damper operators and damper locking setscrews. Coordinate location of doors or panels with other affected contractors.

c. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.7.4.1 Square or Rectangular Dampers

a. Duct Height 12 inches and Less

(1) Frames:
Maximum 19 inches in width, maximum 12 inches in height; minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height; Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

(2) Single Leaf Blades:
Maximum 19 inches in width, maximum 12 inches in height; Minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height; Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

(3) Blade Axles:
To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

Maximum 19 inches in width, maximum 12 inches in height; Galvanized steel, minimum of 3/8 inch square shaft.

More than 19 inches in width, maximum 12 inches in height; Galvanized steel, minimum of 1/2 inch square shaft.

(4) Axle Bearings:
Support the shaft on each end at the frames with shaft bearings. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

Maximum 19 inches in width, maximum 12 inches in height; solid nylon, or equivalent solid plastic, or oil-impregnated bronze bearings.

More than19 inches in width, maximum 12 inches in height; oil-impregnated bronze bearings.

(5) Control Shaft/Hand Quadrant:
Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 50 mm 2 inches off the metal duct surface. Stand-off mounting items

shall be integral with the operator or standard accessory of the damper manufacturer.

(6) Finish: Mill Galvanized

b. Duct Height Greater than 12 inches

Provide dampers with multi-leaf opposed-type blades.

(1) Frames:
Maximum 48 inches in height; maximum48 inches in width; minimum of 16 gauge galvanized steel,
minimum of 5.5 inches long.

(2) Blades:
Minimum of 16 gauge galvanized steel; 6 inch nominal width.

(3) Blade Axles:
To support the blades of round dampers, provide galvanized square steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

(4) Axle Bearings:
Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

(5) Blade Actuator: Minimum 1/2 inch diameter galvanized steel.

(6) Blade Actuator Linkage: Mill Galvanized steel bar and crank plate with stainless steel pivots.

(7) Control Shaft/Hand Quadrant: Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 50 mm 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

(8) Finish: Mill Galvanized

2.7.4.2 Round Dampers

a. Frames:

4 to 20 inches size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

22 to 30 inches size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

32 to 40 inches size: Minimum of 16 gauge galvanized steel, minimum of 10 inches long.

b. Blades:

4 to 20 inches size: Minimum of 20 gauge galvanized steel

22 to 30 inches size: Minimum of 16 gauge galvanized steel

32 to 40 inches size: Minimum of 10 gauge galvanized steel

c. Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

4 to 20 inches size: Minimum of 3/8 inch square shaft.

22 to 30 inches size: Minimum of 1/2 inch square shaft.

32 to 40 inches size: Minimum of 3/4 inch square shaft.

d. Axle Bearings:

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

4 to 20 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

22 to 30 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

32 to 40 inches size: oil-impregnated bronze, or stainless steel sleeve bearing

e. Control Shaft/Hand Quadrant:

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

f. Finish: Mill Galvanized

2.7.5 Automatic Balancing Dampers

Provide dampers as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.7.6 Automatic Smoke Dampers

UL listed multiple blade type, supplied by smoke damper manufacturer, with pneumatic damper operator as part of assembly. Qualified under UL 555S with a leakage rating no higher than Class II or III at an elevated temperature Category B (250 degrees F for 30 minutes). Ensure that pressure drop in the damper open position does not exceed 0.1 inch water gauge with average duct velocities of 2500 fpm.

2.7.7 Diffusers, Registers, and Grilles

Provide factory-fabricated units of steel that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to ASHRAE 70.Provide sound rated and certified inlets and outlets according to ASHRAE 70.Provide sound power level as indicated. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers, except linear slot diffusers. Provide linear slot diffusers with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, protect them by a grille or screen according to NFPA 90A.

2.7.7.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Provide diffusers with air deflectors of the type indicated. Provide air handling troffers or combination light and ceiling diffusers conforming to the requirements of UL Electrical Construction for the interchangeable use as cooled or heated air supply diffusers or return air units. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

2.7.7.2 Registers and Grilles

Provide units that are four-way directional-control type, except provide return and exhaust registers that are fixed horizontal or vertical louver type similar in appearance to the supply register face. Furnish registers with sponge-rubber gasket between flanges and wall or ceiling. Install wall supply registers at least 6 inches below the ceiling unless otherwise indicated. Locate return and exhaust registers 6 inches above the floor unless otherwise indicated. Achieve four-way directional control by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Provide grilles as specified for registers, without volume control damper.

2.7.8 Louvers

Provide louvers for installation in exterior walls that are associated with the air supply and distribution system as specified in Section 08 91 00 METAL WALL LOUVERS.

2.7.9 Bird Screens and Frames

Provide bird screens that conform to ASTM E2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.8 AIR SYSTEMS EQUIPMENT

2.8.1 Fans

Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans shall not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 150 percent of the connected driving capacity. Provide variable pitch motor sheaves for 15 hp and below, and fixed pitch as defined by AHRI Guideline D (A fixed-pitch sheave is provided on both the fan shaft and the motor shaft. This is a non-adjustable speed drive.). Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to AMCA 300. Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to UL 705 and have a UL label.

2.8.1.1 In-Line Centrifugal Fans

Provide in-line fans with centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Mount fans in a welded tubular casing. Provide a fan that axially flows the air in and out. Streamline inlets with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Enclose and isolate fan bearings and drive shafts from the air stream. Provide precision, self aligning ball or roller type fan bearings that are sealed against dust and dirt and are permanently lubricated. Provide L50 rated bearing life at not less than 200,000 hours as defined by

ABMA 9 and ABMA 11. Provide motors with totally enclosed enclosure. Provide manual motor starters across-the-line with general-purpose enclosures.

2.8.1.2 Sidewall Propeller Type Fans

Provide propeller type fans, assembled on a reinforced metal panel with venturi opening spun into panel. Provide direct or V-belt driven fans with wheels less than 24 inches in diameter and provide V-belt driven fans with wheels 24 inches in diameter and larger. Provide fans with wall mounting collar. Provide lubricated bearings. Equip fans with wall housing kits. Provide totally enclosed fan cooled type motor enclosure. Install gravity backdraft dampers where indicated. Provide with accessories as indicates on the plans.

2.8.1.3 Centrifugal Type Power Roof Ventilators

Provide direct or V-belt driven centrifugal type fans with backward inclined, non-overloading wheel. Provide hinged or removable and weatherproof motor compartment housing, constructed of heavy gauge aluminum. Provide fans with birdscreen, disconnect switch as indicated, gravity dampers, and roof curb. Provide dripproof type motor enclosure. Use only lubricated bearings.

2.8.2 Coils

Provide fin-and-tube type coils constructed of seamless copper tubes and aluminum fins mechanically bonded or soldered to the tubes. Provide copper tube wall thickness that is a minimum of 0.016 inches. Provide aluminum fins that are 0.0055 inch minimum thickness. Provide casing and tube support sheets that are not lighter than 16 gauge galvanized steel, formed to provide structural strength.When required, provide multiple tube supports to prevent tube sag. Test each coil at the factory under water at not less than 400 psi air pressure and make suitable for 200 psi working pressure and 300 degrees F operating temperature unless otherwise stated. Mount coils for counterflow service. Rate and certify coils to meet the requirements of AHRI 410.

2.8.2.1 Electric Heating Coil

Provide an electric duct heater coil in accordance with UL 1995 and NFPA 70. Provide duct- or unit-mounted coil. Provide nickel chromium resistor, single stage, strip type coil. Provide coil with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized. Provide galvanized steel or aluminum coil casing and support brackets. Mount coil to eliminate noise from expansion and contraction and for complete accessibility for service.

2.8.3 Air Filters

List air filters according to requirements of UL 900, except list high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method under the Label Service to meet the requirements of UL 586.

2.8.3.1 Extended Surface Pleated Panel Filters

Provide 2 inch depth, sectional, disposable type filters of the size indicated with a MERV of 8 when tested according to ASHRAE 52.2. Provide

initial resistance at 500 fpm that does not exceed 0.36 inches water gauge. Provide UL Class 2 filters, and nonwoven cotton and synthetic fiber mat media. Attach a wire support grid bonded to the media to a moisture resistant fiberboard frame. Bond all four edges of the filter media to the inside of the frame to prevent air bypass and increase rigidity.

2.8.3.2 Extended Surface Nonsupported Pocket Filters

Provide 4 inch depth, sectional, replaceable dry media type filters of the size indicated with a MERV of 13 when tested according to ASHRAE 52.2. Provide initial resistance at 500 fpm that does not exceed 0.45 inches water gauge. Provide UL Class 1 filters. Provide fibrous glass media, supported in the air stream by a wire or non-woven synthetic backing and secured to a galvanized steel metal header. Provide pockets that do not sag or flap at anticipated air flows. Install each filter with an extended surface pleated panel filter as a prefilter in a factory preassembled, side access housing or a factory-made sectional frame bank, as indicated.

2.8.3.3 Cartridge Type Filters

Provide 12 inch depth, sectional, replaceable dry media type filters of the size indicated with a MERV of 13 when tested according to ASHRAE 52.2. Provide initial resistance at 500 fpm that does not exceed 0.56 inches, water gauge. Provide UL class 1 filters, and pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow have no effect on filter integrity or performance. Install each filter with an extended surface pleated media panel filter as a prefilter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.8.3.4 Holding Frames

Fabricate frames from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Equip each holding frame with suitable filter holding devices. Provide gasketed holding frame seats. Make all joints airtight.

2.8.3.5 Filter Gauges

Provide dial type filter gauges, diaphragm actuated draft for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, with white dials with black figures, and graduations with a minimum range of 1 inch of water beyond the specified final resistance for the filter bank on which each gauge is applied. Provide each gauge with a screw operated zero adjustment and two static pressure tips with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

2.9 AIR HANDLING UNITS

2.9.1 Field-Fabricated Air Handling Units

Provide built-up units as specified in paragraph DUCT SYSTEMS. Provide fans, coils spray-coil dehumidifiers, and air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types indicated.

2.9.2 Factory-Fabricated Air Handling Units

Provide single-zone draw-through type or single-zone blow-through type units as indicated. Units shall include fans, coils, airtight insulated casing, filter sections, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, mixing box, spray type humidifier, vibration-isolators, and appurtenances required for specified operation. Provide vibration isolators as indicated. Physical dimensions of each air handling unit shall be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling.

2.9.2.1 Casings

Provide the following:

a. Casing sections 2 inch double wall type as indicated, constructed of a minimum 18 gauge galvanized steel, or 18 gauge corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Inner casing of double-wall units that are a minimum 20 gauge solid galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.

b. Individually removable exterior panels with standard tools. Removal shall not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.

c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 18 gauge outer and 20 gauge inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be a minimum 24 inches wide, the full height of the unit casing or a minimum of 6 foot, whichever is less.

d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 16 gauge galvanized steel, conforming to ASHRAE 62.1. Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Coils shall be individually removable from the casing.

e. Casing insulation that conforms to NFPA 90A. Single-wall casing sections handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having

a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Double-wall casing sections handling conditioned air shall be insulated with not less than 2 inches of the same insulation specified for single-wall casings. Foil-faced insulation is not an acceptable substitute for use with double wall casing. Double wall insulation shall be completely sealed by inner and outer panels.

f. Factory applied fibrous glass insulation that conforms to ASTM C1071, except that the minimum thickness and density requirements do not apply, and that meets the requirements of NFPA 90A. Make air handling unit casing insulation uniform over the entire casing. Foil-faced insulation is not an acceptable substitute for use on double-wall access doors and inspections doors and casing sections.

g. Duct liner material, coating, and adhesive that conforms to fire-hazard requirements specified in DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING. Protect exposed insulation edges and joints where insulation panels are butted with a metal nosing strip or coat to meet erosion resistance requirements of ASTM C1071.

h. A latched and hinged inspection door, in the fan and coil sections. Plus additional inspection doors, access doors and access sections.

2.9.2.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

2.9.2.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.9.2.4 Fans

Provide the following:

a. Fans that are double-inlet, centrifugal type with each fan in a separate scroll. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the entire fan assembly. Mount fans on steel shafts, accurately ground and finished.

b. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11.Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.

c. Fans that are driven by a unit-mounted, or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Furnish belt guards that are the three-sided enclosed type with solid or expanded metal face. Belt drives

shall be designed for not less than a 1.3 service factor based on motor nameplate rating.

d. Motor sheaves that are variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by AHRI Guideline D. Where fixed sheaves are required, the use of variable pitch sheaves is allowed during air balance, but replace them with an appropriate fixed sheave after air balance is completed. Select variable pitch sheaves to drive the fan at a speed that produces the specified capacity when set at the approximate midpoint of the sheave adjustment. Furnish motors for V-belt drives with adjustable bases, and with open enclosures.

e. Motor starters of manual type with general-purpose enclosure. Select unit fan or fans to produce the required capacity at the fan static pressure with sound power level as indicated. Obtain the sound power level values according to AMCA 300, ASHRAE 68, or AHRI 260.

2.9.2.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

2.10 TERMINAL UNITS

2.10.1 Room Fan-Coil Units

Provide base units that include galvanized coil casing, coil assembly drain pan outside air damper, air filter, fans, motor, fan drive, motor switch, an enclosure for cabinet models and casing for concealed models, leveling devices integral with the unit for vertical type units, and sound power levels as indicated. Obtain sound power level data or values for these units according to test procedures based on AHRI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models are acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.Fasten each unit securely to the building structure. Provide units with capacity indicated. Provide room fan-coil units that are certified as complying with AHRI 440, and meet the requirements of UL 1995.

2.10.1.1 Enclosures

Fabricate enclosures from not lighter than 18 gauge steel, reinforced and braced. Provide enclosures with front panels that are removable and have 1/4 inch closed cell insulation or 1/2 inch thick dual density foil faced fibrous glass insulation. Make the exposed side of a high density, erosion-proof material suitable for use in air streams with velocities up to 4,500 fpm. Provide a discharge grille that is adjustable and that is of such design as to properly distribute air throughout the conditioned space. Plastic discharge and return grilles are acceptable provided the plastic material is certified by the manufacturer to be classified as flame resistant according to UL 94 and the material complies with the heat

deflection criteria specified in UL 1995. Provide galvanized or factory finished ferrous metal surfaces with corrosion resistant enamel, and access doors or removable panels for piping and control compartments, plus easy access for filter replacement. Provide duct discharge collar for concealed models.

2.10.1.2 Fans

Provide steel or aluminum, multiblade, centrifugal type fans. In lieu of metal, fans and scrolls could be of non-metallic materials of suitably reinforced compounds with smooth surfaces. Dynamically and statically balance the fans. Provide accessible assemblies for maintenance. Disassemble and re-assemble by means of mechanical fastening devices and not by epoxies or cements.

2.10.1.3 Coils

Fabricate coils from not less than 3/8 inch outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Provide coils with not less than 1/2 inch outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Test coils hydrostatically at 300 psi or under water at 250 psi air pressure. Provide coils suitable for 200 psi working pressure. Make provisions for coil removal.

2.10.1.4 Drain Pans

Size and locate drain and drip pans to collect all water condensed on and dripping from any item within the unit enclosure or casing. Provide condensate drain pans designed for self-drainage to preclude the buildup of microbial slime and thermally insulated to prevent condensation and constructed of not lighter than 21 gauge type 304 stainless steel or noncorrosive ABS plastic. Provide insulation with a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and of a waterproof type or coated with a waterproofing material. Design drain pans so as to allow no standing water and pitch to drain. Provide minimum 3/4 inch NPT or 5/8 inch OD drain connection in drain pan. Provide plastic or metal auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages; if metal, provide auxiliary pans that comply with the requirements specified above. Extend insulation at control and piping connections 1 inch minimum over the auxiliary drain pan.

2.10.1.5 Manually Operated Outside Air Dampers

Provide manually operated outside air dampers according to the arrangement indicated, and parallel airfoil type dampers of galvanized construction. Provide blades that rotate on stainless steel or nylon sleeve bearings.

2.10.1.6 Filters

Provide filters of the fiberglass disposable type, 1 inch thick, conforming to ASTM F 1040. Filters in each unit shall be removable without the use of tools.

2.10.1.7 Motors

Provide motors of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Provide motors with permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Provide a motor power consumption, shown in watts, at the fan operating speed selected to meet the specified capacity that does not exceed the following values:

Free Discharge Motors			
Unit Capacity (L/S) (cfm)	Maximum Power Consumption (Watts)		
	115V	230V	277V
94200	70	110	90
142300	100	110	110
189400	170	150	150
283600	180	210	220
378800	240	240	230
4721000	310	250	270
5661200	440	400	440

High Static Motors	
Unit Capacity (L/S) (cfm)	Maximum Power Consumption (Watts)
94200	145
142300	145
189400	210
283600	320
378800	320
4721000	530
5661200	530

2.10.2 Variable Air Volume (VAV) Units

a. Provide VAV units that are the type, size, and capacity shown, mounted in the ceiling or wall cavity, plus units that are suitable for single duct system applications. Provide actuators and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. For each VAV terminal unit, provide a temperature sensor in the unit discharge ductwork.

b. Provide unit enclosures that are constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Provide single or multiple discharge outlets as required. Units with flow limiters are not acceptable. Provide unit air volume that is factory preset and readily field adjustable without special tools.

c. Attach a flow chart to each unit. Base acoustic performance of the terminal units upon units tested according to AHRI 880 with the calculations prepared in accordance with AHRI 885. Provide sound power level as indicated. Show discharge sound power for minimum and 1-1/2 inches water gauge inlet static pressure. Provide acoustical lining according to NFPA 90A.

2.10.2.1 Variable Volume, Single Duct Terminal Units

Provide variable volume, single duct, terminal units with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Provide units that control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Provide units with an internal resistance not exceeding 0.4 inch water gauge at maximum flow range. Provide external differential pressure taps separate from the control pressure taps for air flow measurement with a 0 to 1 inch water gauge range.

2.11 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A123/A123M or ASTM A924/A924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B117, ASTM D1654, and ASTM D3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D520 Type I.

Factory painting that has been damaged prior to acceptance by the Contracting Officer shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.12 SUPPLEMENTAL COMPONENTS/SERVICES

2.12.1 Refrigerant Piping

The requirements for refrigerant piping are specified in Section 23 23 00 REFRIGERANT PIPING.

2.12.2 Condensate Drain Lines

Provide and install condensate drainage for each item of equipment that generates condensate in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.12.3 Backflow Preventers

The requirements for backflow preventers are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.12.4 Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.12.5 Controls

The requirements for controls are specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS and Section 23 09 23.13 20 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of 3 feet. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices)and an additional 3 feet.

c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

3.2.1 Condensate Drain Lines

Provide water seals in the condensate drain from all units room . Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2.2 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS. Provide concrete for foundations as specified in DIVISION 03 - CONCRETE.

3.2.3 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced. Provide access panels as specified in DIVISION 05 - METALS.

3.2.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

3.2.5 Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

3.2.6 Acoustical Duct Lining

Apply lining in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C916, Type I, NFPA 90A, UL 723, and ASTM E84. Provide top and bottom pieces that lap the side pieces and are secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA 1966. Provide welded pins, cup-head pins, or adhered clips that do not distort the duct, burn through, nor mar the finish or the surface of the duct. Make pins and washers flush with the surfaces of the duct liner and seal all breaks and punctures of the duct liner coating with the nonflammable, fire resistant adhesive. Coat exposed edges of the liner at the duct ends and at other joints where the lining is subject to erosion with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Apply duct liner to flat sheet metal prior to forming duct through the sheet metal brake. Additionally secure lining at the top and bottom surfaces of the duct by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA 1966 to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, are acceptable.

3.2.7 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

3.2.8 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit.

3.2.9 Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.2.10 Power Roof Ventilator Mounting

Provide foamed 1/2 inch thick, closed-cell, flexible elastomer insulation to cover width of roof curb mounting flange. Where wood nailers are used, predrill holes for fasteners.

3.2.11 Power Transmission Components Adjustment

Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.3 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 28 calendar days before being loaded.

3.4 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.5 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks.

3.6 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

a. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 20.

b. Framed Prepared Openings: Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.

c. Insulation: Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.

d. Closure Collars: Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation.Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.

e. Firestopping: Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING.

3.7 FIELD PAINTING OF MECHANICAL EQUIPMENT

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 120 degrees F. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

a. Temperatures less than 120 degrees F: Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat to metal surfaces subject to temperatures less than 120 degrees F.

b. Temperatures between 120 and 400 degrees F: Apply two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of two mils to metal surfaces subject to temperatures between 120 and 400 degrees F.

c. Temperatures greater than 400 degrees F: Apply two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of two mils to metal surfaces subject to temperatures greater than 400 degrees F.

3.8 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.9 DUCTWORK LEAK TESTS

The requirements for ductwork leak tests are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.10 DAMPER ACCEPTANCE TEST

Submit the proposed schedule, at least 2 weeks prior to the start of test. Operate all fire dampers and smoke dampers under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Test each fire damper equipped with fusible link by having the fusible link cut in place. Test dynamic fire dampers with the air handling and distribution system running. Reset all fire dampers with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, install the damper so it is square and free from racking.

3.11 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.12 PERFORMANCE TESTS

After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general operating tests by an experienced engineer. Provide tests that cover a period of not less than 5 days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

Submit test reports for the ductwork leak test, and performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.13 CLEANING AND ADJUSTING

Inside of fan-coil units and air terminal units, thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and install new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Maintain system in this clean condition

until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer.Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.14 OPERATION AND MAINTENANCE

3.14.1 Operation and Maintenance Manuals

Submit two manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in DIVISION 01 - GENERAL REQUIREMENTS. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

3.14.2 Operation and Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of 8 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Certification

1.3 RELATED REQUIREMENTS

This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.4.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.4.4 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.4.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.4.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.4.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's

recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under DIVISION 26 - ELECTRICAL. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of DIVISION 26 - ELECTRICAL.

1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified by a task order, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

1.8 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be

in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

-- End of Section --

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(2002; 6th ed) National Standards for Total System Balance
AABC MN-4	(1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV	(2006) Procedural Standards for Measurements and Assessment of Sound and Vibration
NEBB PROCEDURAL STANDARDS	(2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1143	(1985) HVAC Air Duct Leakage Test Manual, 1st Edition
SMACNA 1780	(2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition
SMACNA 1858	(2004) HVAC Sound And Vibration Manual - First Edition

1.2 DEFINITIONS

a. AABC: Associated Air Balance Council.

b. COR: Contracting Officer's Technical Representative.

c. DALT: Duct air leakage test

d. DALT'd: Duct air leakage tested

e. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.

f. NEBB: National Environmental Balancing Bureau

g. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING." When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."

h. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.

i. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.

j. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.

k. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).

l. TAB: Testing, adjusting, and balancing (of HVAC systems).

m. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.

n. TAB Agency: TAB Firm

o. TAB team field leader: TAB team field leader

p. TAB team supervisor: TAB team engineer.

q. TAB team technicians: TAB team assistants.

r. TABB: Testing Adjusting and Balancing Bureau.

1.2.1 Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems	International Standards for Environmental Systems Balance
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures	Field Readiness Check & Prelim. Field Procedures

1.3 WORK DESCRIPTION

The work includes duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air distribution systems including ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.2 Related Requirements

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Specific requirements related to Reliability Centered Maintenance (RCM) principles and Predictive Testing and Inspection (PTI), by the construction Contractor to detect latent manufacturing and installation defects must be followed as part of the Contractor's Quality Control program. Refer to the paragraph titled, Sustainability, for detailed requirements.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Pre-Final DALT report;

Final DALT report;
DALT and TAB Work Execution Schedule;

DALT and TAB Procedures Summary;

Design review report;

TAB report;

SD-07 Certificates

Prerequisite HVAC Work Check Out List;

Advanced notice for TAB field work;

Independent TAB agency and personnel qualifications;

Advance notice of Pre-Final DALT field work;

Completed Pre-Final DALT Work Checklist;

Advance Notice of TAB Field Work;

Completed Pre-TAB Work Checklist;

DALT and TAB Submittal and Work Schedule;

Design review report;

Pre-field DALT preliminary notification;

Pre-field TAB engineering report;

1.5 QUALITY ASSURANCE

1.5.1 Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Contracting Officer for approval:

a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.

c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.6 SEQUENCING AND SCHEDULING

1.6.1 DALT and TAB Submittal and Work Schedule

Comply with additional requirements specified in Appendix C: DALT AND TAB SUBMITTAL AND WORK SCHEDULE included at the end of this section

1.6.2 DALT and TAB Submittal and Work Schedule

Submit this schedule, and TAB Schematic Drawings, adapted for the particular project, to the Contracting Officer (CO) for review and approval. Include with the submittal the planned calendar dates for each submittal or work item.

1.6.2.1 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.6.2.2 Pre-Field DALT Preliminary Notification

Notification: On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing within 7 calendar days after completion.

1.6.2.3 Pre-Field TAB Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

(1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.

(2) Air System Diagrams: Use the contract drawings and duct fabrication drawings if available to provide air system diagrams in the report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagrams which identifies each outlet contained in the outlet airflow report sheets. Show intended locations of all traverses and static pressure readings.

(3) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or SMACNA 1780 data report forms with the following pre-field information filled in:

(1) Design data obtained from system drawings, specifications, and approved submittals.

(2) Notations detailing additional data to be obtained from the contract site by the TAB field team.

(3) Designate the actual data to be measured in the TAB field work.

(4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. Place the instrument key number in the blank space where the measured data would be entered.

c. Prerequisite HVAC work checkout list: Provide a list of inspections and work items which are to be completed by the Contractor. This list must be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.

At a minimum, a list of the applicable inspections and work items listed in the NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" must be provided for each separate system to be TAB'd.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section as specified in Appendix A WORK DESCRIPTIONS OF PARTICIPANTS.

3.2 PRE-DALT/TAB MEETING

Meet with the Contracting Officer's representative (COR) to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3 DALT PROCEDURES

3.3.1 Instruments, Consumables and Personnel

Provide instruments, consumables and personnel required to accomplish the DALT field work. Follow the same basic procedure specified below for TAB Field Work, including maintenance and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

3.3.2 Advance Notice of Pre-Final DALT Field Work

On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing prior to the COR's duct selection field visit.

3.3.3 Ductwork To Be DALT'd

From each duct system indicated as subject to DALT, the COR will randomly select sections of each completed duct system for testing by the Contractor's TAB Firm. The sections selected will not exceed 20 percent of the total measured linear footage of duct systems indicated as subject to DALT. Sections of duct systems subject to DALT will include 20 percent of main ducts, branch main ducts, branch ducts and plenums for supply, return, exhaust, and plenum ductwork.

It is acceptable for an entire duct system to be DALT'd instead of disassembling that system in order to DALT only the 20 percent portion specified above.

3.3.4 DALT Testing

Perform DALT on the HVAC duct sections of each system as selected by the COR. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in SMACNA 1143.

In spite of specifications of SMACNA 1143 to the contrary, DALT ductwork of construction class of 3-inch water gauge static pressure and below if indicated to be DALT'd. Complete DALT work on the COR selected ductwork within 48 hours after the particular ductwork was selected for DALT.

Separately conduct DALT work for large duct systems to enable the DALT work to be completed in 48 hours.

3.3.5 Pre-final DALT Report

After completion of the DALT work, prepare a Pre-final DALT Report meeting the additional requirements specified in Appendix B REPORTS - DALT and TAB. Data required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the Pre-final DALT report shall provide the basis for the Final DALT Report.

TAB supervisor shall review, approve and sign the Pre-Final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COR that the field check of the Pre-Final DALT Report data can commence.

3.3.6 Quality Assurance - COR DALT Field Acceptance Testing

In the presence of the COR and TAB team field leader, verify for accuracy Pre-final DALT Report data selected by the COR. For each duct system, this acceptance testing shall be conducted on a maximum of 50 percent of the duct sections DALT'd.

Further, if any data on the Pre-final DALT report form for a given duct section is out-of-tolerance, then field acceptance testing shall be conducted on data for one additional duct section, preferably in the same duct system, in the presence of the COR.

3.3.7 Additional COR Field Acceptance Testing

If any of the duct sections checked for a given system are determined to have a leakage rate measured that exceeds the leakage rate allowed by SMACNA Leak Test Manual for an indicated duct construction class and sealant class, terminate data checking for that section. The associated Pre-final DALT Report data for the given duct system will be disapproved. Make the necessary corrections and prepare a revised Pre-final DALT Report. Reschedule a field check of the revised report data with the COR.

3.3.8 Certified Final DALT Report

On successful completion of all field checks of the Pre-Final DALT Report data for all systems, the TAB Supervisor shall assemble, review, approve, sign and submit the Final DALT Report in compliance with Appendix B REPORTS - DALT and TAB to the Contracting Officer for approval.

3.3.9 Prerequisite for TAB Field Work

Do not commence TAB field work prior to the completion and approval, for all systems, of the Final DALT Report.

3.4 TAB PROCEDURES

3.4.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the the requirements of AABC MN-1, or SMACNA 1780 (TABB) and SMACNA 1858 (TABB),except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Conduct TAB work, including measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC MN-4, or NEBB TABES and NEBB MASV, or SMACNA 1780 (used by TABB) and SMACNA 1858 sound measurement procedures, except as supplemented and modified by this section.

3.4.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.4.3 TAB Air Distribution Systems

3.4.3.1 Units With Coils

Report heating and cooling performance capacity tests for hot water, chilled water, DX and steam coils for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

a. For air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of AABC MN-4, Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with AABC MN-4, Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

b. For units with capacities of 7.5 tons (90,000 Btu) or less, such as fan coil units, duct mounted reheat coils associated with VAV terminal units, and unitary units, such as through-the-wall heat pumps:

Determine the apparent coil capacity by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; submit the calculations with the coil reports.

3.4.3.2 Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, variable air volume boxes, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

3.4.3.3 Outside Air Units

Outside air unit systems including fans, coils, ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.4 Cassette and Horizontal Ducted Units

Cassettes and horizontal ducted unit systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

3.4.3.5 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.4.4 TAB Work on Performance Tests Without Seasonal Limitations

3.4.4.1 Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the heating systems and cooling systems.

3.4.4.2 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.4.5 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air and water flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Contracting Officer for direction.

3.4.6 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.4.7 TAB Reports

Additional requirements for TAB Reports are specified in Appendix B REPORTS - DALT and TAB

3.4.8 Quality Assurance - COR TAB Field Acceptance Testing

3.4.8.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COR, random selections of data (water, air quantities, and air motion) recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: Air handling units, cassettes and horizontal duct mounting units.

Group 2: 25 percent of the Change-over Bypass Dampers and associated diffusers and registers.

Group 3: 25 percent of the supply diffusers, registers, grilles associated with constant volume air handling units.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply and exhaust fans.

Further, if any data on the TAB Report for Groups 2 through 5 is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, additional group data verification is required in the presence of the COR. Verify TAB Report data for one additional piece of equipment in that group. Continue this additional group data verification until out-of-tolerance data ceases to be found.

3.4.8.2 Additional COR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the

necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COR.

3.4.8.3 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

3.5 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.6 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

3.7 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS
Appendix B REPORTS - DALT and TAB
Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE
Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

Appendix A

WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

1. Contractor

a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.

b. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.

c. Pre-DALT and TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.

d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.

e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph entitled "Construction Deficiencies." Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.

f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.

g. Give Notice of Testing: Submit advance notice of TAB field work accompanied by completed prerequisite HVAC Work List

h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.

b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.

c. Submittals: Provide the submittals specified herein.

d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.

e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the DALT or TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.

h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.

i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph entitled "Construction Deficiencies."

Resolve each deficiency as soon as practical and submit revised schedules and other required documentation.

j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.

3. TAB Team Field Leader

a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."

b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.

c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

Appendix B

REPORTS - DALT and TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. DALT and TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. Include the following:

a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.

b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.

c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.

d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.

e. A list of DALT and TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.

f. A thorough checklist of the work items and inspections that need to be accomplished before DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.

g. A thorough checklist of the work items and inspections that need to be accomplished before the TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-TAB Work Checklist before the TAB field work can be accomplished.

h. The checklists specified above shall be individually developed and tailored specifically for the work under this contract. Refer to NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under the paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" for examples of items to include in the checklists.

3. Design Review Report

Submit report containing the following information:

a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.

b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.

4. Pre-Final DALT Report for COR DALT Field Checks

Report the data for the Pre-Final DALT Report meeting the following requirements:

a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.

b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1143. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.

c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.

d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.
Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.

e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

5. Final DALT Report

On successful completion of all COR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

6. TAB Reports: Submit TAB Report in the following manner:

a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.

b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.

c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:

All occupied spaces.

(1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.

(2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.

(3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the TAB Report.

d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.

e. Air Static Pressure Profiles: Report static pressure profiles for air duct systems including: AHU-1, OAU-1, and AH-1 types. Report static pressure data for all supply, return, relief, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB or TABB required data, the following:

(1) Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.

(2) Report static pressure drop across chilled water coils, DX coils, hot water coils, steam coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.

(3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.

(4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

(5) Report static pressure drop across outside air and relief/exhaust air louvers.

(6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.

f. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

g. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.

h. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.

i. Data From TAB Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

-- End of Section --

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A240/A240M	(2011a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A580/A580M	(2008) Standard Specification for Stainless Steel Wire
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C1126	(2011e1) Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C1136	(2010) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1290	(2011) Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C1427	(2007e1) Specification for Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form

ASTM C195	(2007) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C449	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C533	(2011) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534/C534M	(2008) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C547	(2011) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C591	(2011) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C610	(2010) Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM C647	(2008) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C795	(2008) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

ASTM D882	(2010) Tensile Properties of Thin Plastic Sheeting
ASTM E2231	(2009) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
ASTM E84	(2011b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2010) Standard Test Methods for Water Vapor Transmission of Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2012) Standard for the Installation of Warm Air Heating and Air Conditioning Systems

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T403 OM	(2010) Bursting Strength of Paper

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-24179	(1969; Rev A; Am 2 1980; Notice 1 1987) Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-A-3316	(1987; Rev C; Am 2 1990) Adhesives, Fire-Resistant, Thermal Insulation

UNDERWRITERS LABORATORIES (UL)

UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials

UL 94 (1996; Reprint Oct 2010) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SYSTEM DESCRIPTION

1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

1.2.2 Surface Burning Characteristics

Unless otherwise specified, insulation shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Test specimens shall be prepared and mounted according to ASTM E2231. Insulation materials located exterior to the building perimeter are not required to be fire rated.

1.2.3 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meets all other requirements of this section. The minimum recycled material content of the following insulation are:

Rock Wool	75 percent slag of weight
Fiberglass	20-25 percent glass cullet by weight
Rigid Foam	9 percent recovered material

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-03 Product Data

Pipe Insulation Systems;
Duct Insulation Systems;

SD-04 Samples

Thermal Insulation;

SD-08 Manufacturer's Instructions

Pipe Insulation Systems;

Duct Insulation Systems;

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material. Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet. Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems which are located within, on, under, and adjacent to buildings; and for plumbing systems. Insulation shall be CFC and HCFC free.

2.2 MATERIALS

Provide insulation that meets or exceed the requirements of ASHRAE 90.1 - IP. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C795 requirements. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free and conform to the following:Flexible Elastomeric: Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive. Comply with ASTM C534/C534M, Type I, Grade 1, for tubular materials and Type II, Grade 1, for sheet

materials. Provide product recognized under UL 94 and listed in FM APP GUIDE.

2.2.1 Adhesives

2.2.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C916, Type I.

2.2.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C195.

2.2.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Adhesive shall be MIL-A-3316, Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation. Submit and display, after approval of materials, actual sections of installed systems, properly insulated in accordance with the specification requirements. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

a. Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

b. Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A temporary covering shall be used to enclose and protect display sections for duct insulation exposed to weather.

2.2.2 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product recognized under UL 94 and listed in FM APP GUIDE.

2.2.3 Caulking

ASTM C920, Type S, Grade NS, Class 25, Use A.

2.2.4 Corner Angles

2.2.4.1 General

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209, Alloy 3003, 3105, or 5005.

2.2.4.2 Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor).

2.2.5 Finishing Cement

ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C795.

2.2.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

2.2.7 Staples

Outward clinching type monel.

2.2.8 Jackets

2.2.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.2.8.2 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

2.2.9 Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber, cellular glass, polyisocyanurate, and phenolic foam. Insulation materials that do not require jacketing are flexible elastomerics. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.9.1 White Vapor Retarder All Service Jacket (ASJ)

Standard reinforced fire retardant jacket for use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.2.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings

a. The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Less than 0.02 permeability when tested in accordance with ASTM E96/E96M. Meeting UL 723 or ASTM E84 flame and smoke requirements; UV resistant.

b. The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined according to procedure B of ASTM E96/E96M utilizing apparatus described in ASTM E96/E96M. The coating shall be a nonflammable, fire resistant type. All other application and service properties shall be in accordance with ASTM C647.

2.2.9.3 Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and excellent WVT.

2.2.9.4 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 30 lb/inch when tested in accordance with ASTM D882, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.9.5 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for Laminated Film Vapor Retarder above.

2.2.9.6 Vapor Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with ASTM E96/E96M). Vapor barrier shall meet UL 723 or ASTM E84 25 flame and 50 smoke requirements; and UV resistant. Minimum burst strength 185 psi in accordance with TAPPI T403 OM. Tensile strength 68 lb/inch width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

2.2.10 Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.11 Wire

Soft annealed ASTM A580/A580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2.12 Insulation Bands

Insulation bands shall be 1/2 inch wide; 26 gauge stainless steel.

2.2.13 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.3 PIPE INSULATION SYSTEMS

Insulation materials shall conform to Table 1. Insulation thickness shall be as listed in Table 2 and meet or exceed the requirements of ASHRAE 90.1 - IP. Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 Aboveground Cold Pipeline (-30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

a. Cellular Glass: ASTM C552, Type II, and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

b. Flexible Elastomeric Cellular Insulation: ASTM C534/C534M, Grade 1, Type I or II. Type II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation.

c. Phenolic Insulation: ASTM C1126, Type III. Phenolic insulations shall comply with ASTM C795 and with the ASTM C665 paragraph Corrosiveness. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

d. Polyisocyanurate Insulation: ASTM C591, type I. Supply the insulation with manufacturer's recommended factory-applied vapor retarder/vapor barrier. Insulation with pre-applied adhesive shall not be used.

e. Flexible Polyolefin Cellular Insulation: ASTM C1427, Grade 1 Type I or II.

f. Mineral Fiber Insulation with Integral Wicking Material (MFIWM): ASTM C547. Install in accordance with manufacturer's instructions.

2.3.2 Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

a. Mineral Fiber: ASTM C547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

b. Calcium Silicate: ASTM C533, Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket/vapor barrier.

c. Cellular Glass: ASTM C552, Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

d. Flexible Elastomeric Cellular Insulation: ASTM C534/C534M, Grade 1, Type I or II to 220 degrees F service.

e. Phenolic Insulation: ASTM C1126 Type III to 250 degrees F service shall comply with ASTM C795. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

f. Perlite Insulation: ASTM C610

g. Polyisocyanurate Insulation: ASTM C591, Type 1, to 300 degrees F service. Supply the insulation with manufacturer's recommended factory applied jacket/vapor barrier.

h. Flexible Polyolefin Cellular Insulation: ASTM C1427, Grade 1 Type I or II to 200 degrees F.

2.4 DUCT INSULATION SYSTEMS

2.4.1 Duct Insulation

Provide factory-applied cellular glass polyisocyanurate or phenolic foam insulation with insulation manufacturer's standard reinforced fire-retardant vapor barrier, with identification of installed thermal resistance (R) value and out-of-package R value.

2.4.1.1 Rigid Insulation

Rigid mineral fiber in accordance with ASTM C612, Class 2 (maximum surface temperature 400 degrees F), 3 pcf average, 1-1/2 inch thick, Type IA, IB, II, III, and IV.

2.4.1.2 Blanket Insulation

Blanket flexible mineral fiber insulation conforming to ASTM C553, Type 1, Class B-3, 3/4 pcf nominal, 2.0 inches thick or Type II up to 250 degrees F. Also ASTM C1290 Type III may be used.

2.4.2 Duct Insulation Jackets

2.4.2.1 All-Purpose Jacket

Provide insulation with insulation manufacturer's standard reinforced fire-retardant jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jacket with a white surface suitable for field painting.

2.4.2.2 Metal Jackets

a. Aluminum Jackets: ASTM B209, Temper H14, minimum thickness of 27 gauge (0.016 inch), with factory-applied polyethylene and kraft paper

moisture barrier on inside surface. Provide smooth surface jackets for jacket outside dimension 8 inches and larger. Provide corrugated surface jackets for jacket outside dimension 8 inches and larger. Provide stainless steel bands, minimum width of 1/2 inch.

b. Stainless Steel Jackets: ASTM A167 or ASTM A240/A240M; Type 304, minimum thickness of 33 gauge (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 1/2 inch.

2.4.2.3 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive), heavy duty white or natural).

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi-layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.2 Firestopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION. The protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by UL, FM, or a NRTL.

3.1.3 Painting and Finishing

Painting shall be as specified in DIVISION 09 - FINISHES.

3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 220 degrees F. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish or PVC or metal jacketing as recommended by the manufacturer after the adhesive is dry and cured. A brush coating of adhesive shall be applied to both butt ends to be joined and to both slit surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.5 Welding

No welding shall be done on piping, duct</TAI> or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Air chambers.

e. Adjacent insulation.

f. ASME stamps.

g. Access plates of fan housings.

h. Cleanouts or handholes.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where pipes penetrate interior walls, the aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 plies standard grade, silver, white, black and embossed shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

h. For hot water pipes supplying lavatories or other similar heated service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.

i. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inches.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers in accordance with MSS SP-69, and Section 22 00 00 PLUMBING, GENERAL PURPOSE.

c. Horizontal pipes larger than 2 inches and below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, prefabricated insulation pipe hangers, perlite above 80 degrees F), or the necessary strength polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as

an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.1.5 Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, welded PVC, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket, - less than 0.0000 permeability; (greater than 3 ply, standard grade, silver, white, black and embossed) aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

3.2.1.6 Pipe Insulation Material and Thickness

TABLE 1
Insulation Material for Piping
Service

	Material	Specification	Type	Class	VR/VB Req'd
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping					
	Polyisocyanurate	ASTM C591	I		Yes
	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Flexible Polyolefin Cellular	ASTM C1427	I		No
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)					
	Mineral Fiber	ASTM C547	I	1	No
	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Polyisocyanurate	ASTM C591	I		No
Refrigerant Suction Piping (1.67 degrees C35 degrees Fnominal)					

	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Cellular Glass	ASTM C552	II	1	Yes
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Polyisocyanurate	ASTM C591	I		Yes
Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas for Handicapped Personnel					
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Flexible Polyolefin Cellular	ASTM C1427	I		No
Hoizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)					
	Polyisocyanurate	ASTM C591	I		Yes
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Cellular Glass	ASTM C552	III		Yes
Condensate Drain Located Inside Building					
	Polyisocyanurate	ASTM C591	I		Yes

	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	II		Yes
Note: VR/VB = Vapor Retarder/Vapor Barrier					

TABLE 2

Piping Insulation Thickness (mminch)
For flexible cellular foam the thickness should be 13mm instead of 15mm. Economic thicknessor prevention of condensation is the basis of these tables. If prevention of condensation is the criterion, the ambient temperature and relative humidity must bestated.

Service

	Material	Tube And Pipe Size (mm) (inch)				
		<25<1	25-<401-<1.5	40-<1001.5-<4	100-<2004-<8	> or = 200>8
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A

	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)						
	Mineral Fiber	251	251	251	401.5	401.5
	Cellular Glass	401.5	401.5	401.5	502	502
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Polyisocyanurate	251	251	251	251	401.5
Refrigerant Suction Piping (1.67 degrees C35 degrees Fnominal)						
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251

Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas forHandicapped Personnel						
	Flexible Elastomeric Cellular	130.5	130.5	130.5	130.5	130.5
Hoizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251
Condensate Drain Located Inside Building						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Faced Phenolic Foam	251	251	251	251	251

3.2.2 Aboveground Cold Pipelines

The following cold pipelines for minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

a. Make-up water.

b. Horizontal and vertical portions of interior roof drains.

c. Refrigerant suction lines.

d. Air conditioner condensate drains.

e. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

f. Domestic cold and chilled drinking water.

3.2.2.1 Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

3.2.2.2 Factory or Field applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or field applied seal welded PVC jacket or greater than 3 ply laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, standard grade, sliver, white, black and embossed for use with Mineral Fiber, Cellular Glass, Phenolic Foam, and Polyisocyanurate Foam Insulated Pipe. Insulation inside the building, to be protected with an aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, Embossed Silver, White & Black, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, White & Black, shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white & black, shall be provided for pipe insulation to the 6 ft level.

3.2.2.3 Installing Insulation for Straight Runs Hot and Cold Pipe

a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating, greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or PVDC adhesive tape.

b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. If staples are used, they shall be sealed in accordance with item "e." below. Note that staples are not required with cellular glass systems.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. The patch shall extend not less than 1-1/2 inches past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

h. Installation of flexible elastomeric cellular pipe insulation shall be by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut.Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives shall be used. Grade 1, Type II sheet insulation when used on pipe larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow'. Submit a booklet containing completed MICA Insulation Stds plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.

(1) The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.

(2) If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with either greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape, standard grade, silver, white, black and embossed or PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

3.2.3.1 General Requirements

All hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

a. Domestic hot water supply & re-circulating system.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.3.2 Insulation for Fittings and Accessories

a. General. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

b. Precut or Preformed. Precut or preformed insulation shall be placed around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

c. Rigid Preformed. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular

insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe.

PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant.

3.2.4.3 PVC Jacket

PVC jacket shall be ultraviolet resistant and adhesive welded weather tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.3 DUCT INSULATION SYSTEMS INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

3.3.1 Duct Insulation Thickness

Table 3		
Minimum Duct Insulation		
	Cooling	Heating

Duct Location	Annual Cooling Degree Days Base 18 C 65 F	Insulation R-Value (sm K)/W (h sf F)/Btu	Annual Heating Degree Days Base 18 C 65 F	Insulation R-Value (sm K)/W (h sf F)/Btu
Exterior of Building	<260500	0.583.3	<8161500	0.583.3
	260 - 621500 - 1150	0.885.0	816 - 24821500 - 4500	0.885.0
	622 - 10931151 - 2000	1.146.5	2483 - 41494501 - 7500	1.146.5
	>10932000	1.418.0	>41497500	1.418.0
	Temperature Difference	Insulation R-Value (sm K)/W (h sf F)/Btu	Temperature Difference	Insulation R-Value (sm K)/W (h sf F)/Btu
Inside building envelope or in unconditioned spaces	<815	None required	<815	None required
	8 <TD <2215 <TD <40	0.583.3	8 <TD <2215 <TD <40	0.583.3
	22 <TD40 <TD	0.885.0	22 <TD40 <TD	0.885.0

These R-values do not include the film resistances. The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit vapor transmission and condensation. Where ducts are designed to convey both heated and cooled air, duct insulation shall be as required by the most restrictive condition. Where exterior walls are used as plenum walls, wall insulation shall be a required by the most restrictive condition of this section or the insulation for the building envelope. Cooling ducts are those designed to convey mechanically cooled air or return ducts in such systems. Heating ducts are those designed to convey mechanically heated air or return ducts in such systems. Thermal resistance will be measured in accordance with ASTM C518 at a mean temperature of 24 degrees C 75 drgrees F. The Temperature difference is at design conditions between the space withinwhich the duct is located and the design air temperature in the duct. Resistance for runouts to terminal devices less than 3 m10 feet in length need not exceed 0.58 (sm K)/W3.3 (h sf F)/Btu. Unconditioned spaces include crawlspaces and attics.

Duct insulation thickness shall be in accordance with Table 4.

Table 4 - Minimum Duct Insulation (mm) (inches)	
Cold Air Ducts	502.0

Relief Ducts	401.5
Fresh Air Intake Ducts	401.5
Warm Air Ducts	502.0
Relief Ducts	401.5
Fresh Air Intake Ducts	401.5

3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible run-outs (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

i. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf, and rigid type where exposed, minimum density 3 pcf. Insulation for both concealed or exposed round/oval ducts shall be flexible type, minimum density 3/4 pcf or a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered. Insulation for all exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a field applied vapor retarder/vapor barrier jacket coating finish as specified, the total field applied dry film thickness shall be approximately 1/16 inch. Insulation on all concealed duct shall be provided with a factory-applied Type I or II vapor retarder/vapor barrier jacket. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder/vapor barrier shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder/vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, flexible insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder/vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Where mechanical fasteners are used, self-locking washers shall be installed and the pin trimmed and bent over.

f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

a. Supply ducts.

b. Return air ducts.

c. Relief air ducts

d. Flexible run-outs (field insulated).

e. Plenums.

f. Duct-mounted coil casings.

i. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, and rigid type where exposed. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured and stapled on 4 inch centers.

3.3.3.2 Installation on Exposed Duct

a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 16 inches apart and not more than 6 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.

b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin trimmed and bent over.

d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of tape and brushed with vapor retarder coating.

e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by staples spaced not more than 16 inches and not more than 6 inches from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

-- End of Section --

SECTION 23 08 00.00 23N

COMMISSIONING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA DCS	(1995, 2nd Ed) HVAC Duct Construction Standards - Metal and Flexible

1.2 DEFINITIONS

1.2.1 Commissioning

The process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent.

1.2.2 Commissioning Authority (Designation Ca)

The person, persons, or Company responsible, on the Government's behalf, for ensuring the commissioning process is fully carried out according to the contract requirements.

1.2.3 Commissioning Agent (Designation Cx)

The person responsible, on the contractors behalf, for carrying out the detailed planning, and implementation of, the commissioning process.

1.2.4 Design Agent (Designation D)

The Designer of Record. For IDIQ task orders, this is typically the Government PM.

1.2.5 TAB

Testing, Adjusting and Balancing

1.2.6 BAS

Building Automation System

1.2.7 DDC

Direct Digital Control

1.2.8 Season 1

That season when the HVAC System is up against maximum loading for the first time after completion of construction. Season 1 can be summer or winter depending on when construction is completed.

1.2.9 Season 2

That season when the HVAC System is up against maximum loading for the second time after completion of construction. Season 2 is the opposite of season 1. I.e. if Season 1 was summer, Season 2 will be winter.

1.2.10 Shoulder Season

That time of the season when the HVAC System is up against part load conditions.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Commissioning Team;

List of team members with company name and contact information who will represent the Contractor in the pre-commissioning checks and functional performance testing.

Test Reports;

All test reports, manufacturer's start-up tests, and executed and signed pre-commissioning checklists and functional performance test checklists required by the executive plan. The results of failed tests shall be included along with a description of the corrective action taken.

SD-07 Certificates

Certificates;

Provide Contractor's Commissioning Agent qualifications and resume. The Contractor's Commissioning Agent shall be Certified by a recognized Building HVAC Commissioning Program per the National Environmental Balancing Bureau or the Associated Air Balance Council or the Building Commissioning Association.

Additionally, for the Commissioning Agent proposed for approval, submit information certifying that the Commissioning Agent is part of the General Contractor's (GC's) staff or first tier certified TAB company or is a first tier subcontractor who is not affiliated with any other company participating in work on this contract.

SD-10 Operation and Maintenance Data

Operation and Maintenance;

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.4 SEQUENCING AND SCHEDULING

The work described in Checklist A of this Section shall be completed in conjunction with the startup of the HVAC systems and the related sections listed herein. The work described in Checklist B of this section shall begin only after all work required in this and related Sections has been successfully completed, and all tests and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Related Sections include, but are not limited to:

Section 01 45 00 CONSTRUCTION QUALITY CONTROL
Section 23 09 54.00 20 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC SYSTEMS
Section 23 08 00.00 20 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
Division 23XXX Mechanical systems as applicable

1.5 RELATED REQUIREMENTS

Requirements for construction scheduling, including commissioning activities, are specified in Section 01 32 00 PROJECT SCHEDULE.

Construction Quality Control Program commissioning requirements are specified in Section 01 45 00.

1.6 COMMISSIONING MEETINGS

Conduct weekly commissioning meetings during the period when commissioning activities take place.

1.7 PRICE AND PAYMENT PROCEDURES FOR COMMISSIONING RELATED ACTIVITIES

Payment for HVAC Systems shall not exceed 70% for the system labor and material cost until such time as the system commissioning as defined by this section is complete and accepted by the government.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. The Commissioning Agent is responsible for ensuring the completeness and technical accuracy of the commissioning plan. In addition, the Government will be represented by a representative of the Contracting Officer and the Design Agent's Representative. The team members shall be as follows:

Designation	Function
Cx	Contractor's Commissioning Agent
Q	Contractor's Quality Control Representative
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing Representative
C	Contractor's Controls Representative
D	Design Agent's Representative (Gov't)
Ca	Contracting Officer's Representative

Appendices A and B are provided as a general checklist and have been prepared to best match the various equipment selected during the design of this project. Each checklist shown in Appendices A and B shall be reviewed and modified as necessary to reflect all equipment actually installed during construction of the project. The commissioning team shall review the accuracy and applicability of each item in the checklist and revise as needed. Equipment shown in the checklist but not installed for the project shall be annotated as "NA". Likewise, equipment installed but not listed in the checklist shall be added or revised accordingly. A note as to why it was added or revised shall be inserted with the reviewer's initial. The commissioning team shall also add or modify to any of the equipment checklist items as required and/or specified by the equipment manufacturer. Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date, unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.

3.2 TESTS

The pre-commissioning checks and functional performance tests shall be performed on all HVAC equipment in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required, including part load testing. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members. The Contractor shall submit Test Reports as specified in the Submittals paragraph.

3.2.1 Pre-Commissioning Checks

Pre-commissioning checks shall be performed for the items indicated on the checklists in Appendix A. All related manufacturer's start up sheets shall

be attached to the appropriate checklist. Deficiencies discovered during these checks shall be documented, corrected and retested in accordance with the applicable contract requirements.

3.2.2 Functional Performance Tests

Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional performance tests shall begin only after all pre-commissioning checks and work required in specification sections listed in the SEQUENCING AND SCHEDULING section have been successfully completed. Tests shall prove Heating, Cooling and Part Load sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall document and correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

3.3 INDEX OF CHECK LISTS

A Pre-commissioning Check Lists

A-1 Structural/Architectural Checklist
A-2 Piping
A-3 Ductwork
A-6 Variable Volume Air Handling Unit
A-7 VAV Terminal
A-8 DX Air Cooled Condensing Unit
A-9 Pumps
A-10 Packaged Air Cooled Chiller
A-15 Blower Coil Unit
A-16 Fan Coil Unit
A-17 Unit Heater
A-18 Exhaust Fan
A-19 Make Up Air Fan
A-20 HVAC System Controls

B. Functional Performance Tests (FPT) and Check Lists

B-1 Pumps
B-4 VAV Terminals
B-5 Variable Volume Air Handling Unit
B-8 Packaged Air Cooled Chiller

B-11 Blower Coil Unit
B-12 Fan Coil Units
B-13 Unit Heaters

B-15 Make Up Air Fan
B-16 Exhaust Fan

3.4 APPENDIX A

PRE-COMMISSIONING CHECKLISTS

A-1 Pre-commissioning Checklist - Structural/Architectural Checklist

For Building or Zone:

Checklist Item	Q	M	E	T	C	D	Ca	Cx
a. Verify all piping,ductwork,EMT,etc. wall/ceiling and floor penetrations in Mesh. rooms or utility chases are sealed with approved fire stopping and/or weatherproof sealants.	___	X	X	X	X	___	_	___
b. Verify the fire rating for the Mesh. equipment room(s) is met per the plans and specs.	___	X	X	X	X	___	_	___
c. Verify the Bldg. envelope is sealed	___	X	X	X	X	___	_	___

per the plans and specs.

d.	Verify the fenestration is rated per the plans and specs and installed correctly. (Fire ratings, force protection, window system shading coefficient / emissivity).	___	XX	X	X	_____
e.	Verify the building is sealed and walls,doors,and dropped ceilings in place prior to the TAB air balance work.	___	X	X	___ X	_____

A-2 Pre-commissioning checklist - Piping

For Chilled Water Piping System

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).			X	X	X			
b. Piping complete.			X					
c. As-built shop drawings submitted.			X					
d. Piping flushed and cleaned and initial chemical treatment added.			X					
e. Strainers cleaned.			X					
f. Valves installed as required.			X		X			
g. Piping insulated as required.			X					
h. Thermometers and gauges installed as required.			X		X			
i. Verify operation of valves.			X					
j. Air vents installed as specified.			X	X	X			
k. Flexible connectors installed as specified			X	X	X			
l. Verify that piping has been labeled and valves identified as specified.			X					
m. Hydrostatic test complete.			X		X			
n. Verify insulation support blocks installed at piping loading points.			X		X			

A-3 Pre-commissioning Checklist - Ductwork

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Ductwork complete.			X		X			
c. As-built shop drawings submitted.			X		X			
d. Ductwork leak test complete.			X		X			
e. Fire dampers, smoke dampers, and access doors installed as required.			X		X			
e. Fire dampers, smoke dampers, and access doors installed as required with installation of each verified by the specified team members initialing each location on a copy of the as-built drawings.			X		X			
f. Ductwork insulated as required.			X		X			
g. Thermometers and gauges installed as required.								
h. Verify open/closed status of dampers.			X		X			
i. Verify smoke and fire damper operation.			X					
j. Flexible connectors installed as specified			X		X			
k. Verify duct systems installed per SMACNA DCS			X		X			

A-6 Pre-commissioning Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1, AHU-2

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			

b. Vibration isolation devices installed. _____ X X X _____

c. Inspection and access doors are operable and sealed.		X		X	
d. Casing undamaged.		X	X	X	
e. Insulation undamaged.		X	X	X	
f. Condensate drainage is unobstructed and sloped correctly. (Visually verify drainage by pouring a cup of water into drain pan.)		X	X	X	
g. Fan belt adjusted.		X		X	
h. Manufacturer's required maintenance clearance provided.		X	X	X	
Electrical					
a. Power available to unit disconnect.			X	X	
b. Power available to unit control panel.			X		
c. Proper motor rotation verified.				X	
d. Verify that power disconnect is located within sight of the unit it controls.			X		
f. Verify proper overload protection for motor starters.			X		
g. Verify that frequency drive, cables, and motor are compatible.			X		
h. Verify that the frequency drive programming is application specific.			X		
Coils					
a. Chilled water piping properly connected.		X	X	X	
b. Chilled water piping pressure tested.		X	X	X	
c. Air vents installed on water coils with shutoff valves as specified.		X	X	X	
d. Any damage to coil fins has been repaired.		X		X	
Controls					

a. Control valves/actuators properly installed.	_____	X	_____	___	___	
b. Control valves/actuators operable.	___	___	X	_____		

c. Dampers/actuators properly installed.		X				
d. Dampers/actuators operable.		X				
e. Verify proper location, installation and calibration of duct static pressure sensor.		X				
f. Fan air volume controller operable.		X				
g. Air handler controls system operational.		X				
Testing, Adjusting, and Balancing (TAB)						
a. Construction filters removed and replaced.			X		X	
b. Permanent Strainers cleaned or Construction strainers removed and replaced.		X		X		

A-7 Pre-commissioning Checklist - VAV Terminal

For all VAV Terminal

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. VAV terminal in place.			X	X	X			
c. VAV terminal ducted.			X	X	X			
d. VAV terminal connected to controls.			X	X				
e. Electric reheat coil connected to local disconnect and heater sized properly with proper overload protection.					X			
f. Manufacturer's required maintenance clearance provided.			X	X	X			
Controls								
a. Cooling only VAV terminal controls set.			X	X				
b. Cooling only VAV controls verified.			X	X				
c. Reheat VAV terminal controls set.			X	X				
d. Reheat terminal/coil controls verified.			X	X				
Testing, Adjusting, and Balancing (TAB)								
a. Verify terminal maximum air flow set.			X					
b. Verify terminal minimum air flow set.			X					
c. Verify that flow coefficient is programmed properly.			X					
d. Permanent Strainers cleaned or Construction strainers removed and replaced.			X		X			

A-9 Pre-commissioning Checklist - Pumps

For Pump: P-1, P-2

Checklist Item	Q	M	E	T	C	D	Ca	Cx

Installation					
a. Verify that item(s) installed meet approved submittal(s).			X	X	
b. Pump vibration isolation devices functional.		X	X	X	
c. Pump/motor coupling alignment verified.		X	X	X	
d. Piping system installed.		X	X	X	
e. Piping system pressure tested.		X	X	X	
f. Pump not leaking.		X	X	X	
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.		X	X	X	
h. Pressure/temperature gauges installed.		X		X	
i. Piping system cleaned.		X	X	X	
j. Chemical water treatment complete.		X	X	X	
Electrical					
a. Power available to pump disconnect.			X	X	
b. Pump rotation verified.			X	X	
c. Control system interlocks functional.			X		
d. Verify that power disconnect is located within sight of the unit it controls.			X		
e. Verify proper overload protection for motor starters.			X		
f. Verify that frequency drive, cables, and motor are compatible.			X		
g. Verify that the frequency drive programming is application specific.			X		

Testing, Adjusting, and Balancing (TAB)

a. Permanent Strainers cleaned or Construction strainers removed and replaced.	_____	X	___	X _____

A-10 Pre-commissioning Checklist - Packaged Air Cooled Chiller

For Chiller: ACC-1

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Chiller properly piped.			X					
c. Chilled water pipe leak tested.			X	X	X			
d. Verify that refrigerant used complies with specified requirements.			X	X	X			
e. Any damage to coil fins has been repaired.			X		X			
f. Manufacturer's required maintenance clearance provided.			X	X	X			
g. Verify proper chiller barrel and piping heat trace installed per manufacturer's recommendations.			X	X	X			
h. Verify unit has Hot Gas Bypass.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Power available to unit control panel.				X				
c. Separate power is supplied to electric heating tape with GFCI breakers.				X				
d. Verify that power disconnect is located within sight of the unit it controls.				X				
Controls								
a. Factory startup and checkout complete.			X	X				
b. Chiller safety/protection devices tested.			X	X				
c. Chilled water flow switch installed.			X	X				
d. Chilled water flow switch tested.			X	X				
e. Chilled water pump interlock installed.			X	X	X			

f. Chilled water pump interlock tested. _____ X _____ ___

[g. Verify low ambient controls. _____ X _____ ___] ___

A-15 Pre-commissioning Checklist - Blower Coil Unit

Blower Coil Unit

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).	___	_____		X	X		_____	
b. Vibration isolation devices installed.	_____		X	X	X		_____	
c. Access doors/removable panels are operable and sealed.	_____		X	___	X		_____	
d. Casing undamaged.	_____		X	X	X		_____	
e. Insulation undamaged.	_____		X	X	X		_____	
f. Condensate drainage is unobstructed and sloped correctly.	_____		X	X	X		_____	
g. Fan belt adjusted.	_____		X	___	X		_____	
h. Any damage to coil fins has been repaired.	_____		X	___	X		_____	
i. Manufacturer's required maintenance clearance provided.	_____		X	X	X		_____	
j. Verify installation of auxiliary drain pan for control valves.	_____		X	X	X		_____	
k. Verify air vent installed per manufacturer's recommendations.	_____		X	X	X		_____	
Electrical								
a. Power available to unit disconnect.	_____			X	_____			___
b. Power available to unit control panel.	_____			X	_____			___
c. Proper motor rotation verified.	___	___	_____		X		_____	
d. Verify that power disconnect is located within sight of the unit it controls.	_____			X	_____			___
e. Power available to electric heating coil.	_____	___	X		X		_____	
f. Verify proper overload protection for _____ motor starters.								

___ X _____

Controls

a. Control interlocks properly installed.			X		
b. Control interlocks operable.			X		
c. Dampers/actuators properly installed.		X			
d. Dampers/actuators operable.		X			
e. Verify proper location and installation of thermostat.		X			

A-16 Pre-commissioning Checklist - Fan Coil Unit

Fan Coil Unit

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Vibration isolation devices installed.			X	X	X			
c. Access doors/removable panels are operable and sealed.			X		X			
d. Casing undamaged.			X	X	X			
e. Insulation undamaged.			X	X	X			
f. Condensate drainage is unobstructed and sloped correctly.			X	X	X			
g. Fan belt adjusted.			X		X			
h. Any damage to coil fins has been repaired.			X		X			
i. Manufacturer's required maintenance clearance provided.			X	X	X			
j. Verify installation of auxiliary drain pan for control valves.			X	X	X			
k. Verify air vent installed per manufacturer's recommendations.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Power available to unit control panel.				X				
c. Proper motor rotation verified.					X			
d. Verify that power disconnect is located within sight of the unit it controls.				X				
e. Power available to electric heating coil.			X	X				

f. Verify proper overload protection for motor starters. _____ ___ X _____

Coils

a. Chilled water piping properly connected.		X	X	X		
b. Chilled water piping pressure tested.		X	X	X		
c. Verify coil filled and vented of air.			X			

Controls

a. Control valves/actuators properly installed.		X				
b. Control valves/actuators operable.		X	X			
c. Verify proper location and installation of thermostat.		X				

Testing, Adjusting, and Balancing (TAB)

a. Construction filters removed and replaced.			X			
b. Permanent Strainers cleaned or Construction strainers removed and replaced.		X		X		

A-17 Pre-commissioning Checklist - Unit Heater

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Any damage to coil fins has been repaired.			X		X			
c. Manufacturer's required maintenance/ operational clearance provided.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Proper motor rotation verified.				X	X			
c. Verify that power disconnect is located within sight of the unit it controls.				X				
d. Power available to electric heating coil.				X				
e. Verify proper overload protection for motor starters.				X				
Controls								
a. Control valves properly installed.			X					
b. Control valves operable.			X	X				
c. Verify proper location and installation of thermostat.			X					
Testing, Adjusting, and Balancing (TAB)								
a. Permanent Strainers cleaned or Construction strainers removed and replaced.			X		X			

A-18 Pre-commissioning Checklist - Exhaust Fan

For Exhaust Fan

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Fan belt adjusted.			X		X			
c. Verify all ductwork is installed per design.			X		X			
Electrical								
a. Power available to fan disconnect.				X				
b. Proper motor rotation verified.					X			
c. Verify that power disconnect is located within sight of the unit it controls.				X				
d. Verify proper overload protection for motor starters.				X				
Controls								
a. Control interlocks properly installed.				X				
b. Control interlocks operable.				X				
c. Dampers/actuators properly installed.			X					
d. Dampers/actuators operable.			X					
e. Verify proper location and installation of thermostat.			X					

A-19 Pre-commissioning Checklist - Make-Up Air Fan

Installation

a. Verify that item(s) installed meet approved submittal(s).			X	X	
b. Fan belt adjusted.		X		X	
c. Verify all ductwork is installed per design.		X		X	

Electrical

a. Power available to fan disconnect.		X			
b. Proper motor rotation verified.				X	
c. Verify that power disconnect is located within sight of the unit it controls.		X			
d. Verify proper overload protection for motor starters.			X		

Controls

a. Control interlocks properly installed.			X		
b. Control interlocks operable.			X		
c. Dampers/actuators properly installed.		X			
d. Dampers/actuators operable.		X			
e. Verify proper location and installation of thermostat.		X			

A-20 Pre-commissioning Checklist - HVAC System Controls

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Layout of control panel matches drawings.			X	X				
c. Control components piped and/or wired to each labeled terminal strip.			X	X				
d. Verify that control components are installed in the proper location.			X	X				
e. Verify that force protection shut down controls installed in proper location.			X	X				
f. DDC connection made to each labeled terminal strip as shown.			X	X				
g. Control wiring and tubing labeled at all terminations, splices, and junctions.			X	X				
h. Shielded wiring used on electronic sensors.			X	X				
i. Verify location and coordination of modem/communication line.			X	X				
j. Verify damper actuators mounted outside the airstream and attached to proper structural support.			X	X				
k. Verify thermostats are located on interior walls with specified options and set to design setpoints.			X	X				
l. Verify that workstation is in proper location and includes all specified interfaces.			X	X				

Main Power and Control Air

a. 110 volt AC power available to panel.			X		
b. 20 psig compressed air available to panel.		X	X		
c. Verify proper overload protection for motor starters.			X		
d. Verify proper sizing and installation of individual control transformers.			X		
e. Verify proper surge protection of incoming power, control wiring, and communication lines.			X		

3.5 APPENDIX B

FUNCTIONAL PERFORMANCE TESTS (FPT) AND CHECKLISTS

All equipment and control systems shall be operated through the entire specified sequence of operations, as directed by the government for witnessing and verifying acceptable operation. Government shall select of specific components or systems to be verified. A functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. Upon failure of any functional performance test, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. In the event of a failed FPT, Government shall have the right to require additional testing of at least similar systems. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members.

B-1 Functional Performance Test Checklist - Pumps

For Pump: P-1, P-2

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Verify automatic interface with local controller and BAS/ operator work station.

2. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

3. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-4 Functional Performance Test Checklist - VAV Terminals

VAV boxes (Cooling only, Reheat)

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	
Contractor's Mechanical Representative	
Contractor's Electrical Representative	
Contractor's Testing, Adjusting and Balancing Representative	
Contractor's Controls Representative	
Contracting Officer's Representative	

B-5 Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1, AHU-2

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

5. Verify that the Variable Frequency Drive is not capable of running at any critical vibration frequencies.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-8 Functional Performance Test Checklist - Packaged Air Cooled Chiller

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

5. Verify that the Variable Frequency Drive is not capable of running at any critical vibration frequencies.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-11 Functional Performance Test Checklist - Steam Boiler

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____

B-12 Functional Performance Test Checklist - Fan Coil Units

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____

B-13 Functional Performance Test Checklist - Unit Heaters

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-15 Functional Performance Test Checklist - Make Air Fan

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-16 Functional Performance Test Checklist - Exhaust Fan

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

-- End of Section --

SECTION 23 09 23.13 20

BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2007) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2010; INT 1 2011; Addenda AD & AE 2011) BACnet—A Data Communication Protocol for Building Automation and Control Networks

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1	(1999) Local Area Network: Token Bus

ASME INTERNATIONAL (ASME)

ASME B31.1	(2010) Power Piping
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-C	(2010) Control Network Protocol Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2008) Standard Requirements for Instrument Transformers
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.45	(2002; R 2008) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less)AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3	(2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code
NFPA 72	(2010; TIA 10-4) National Fire Alarm and Signaling Code
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449	(2006; Reprint Feb 2011) Surge Protective Devices
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 508A	(2001; Reprint Feb 2010) Industrial Control Panels
UL 916	(2007; Reprint Jun 2010) Standard for Energy Management Equipment

1.2 DEFINITIONS

1.2.1 ANSI/ASHRAE Standard 135

ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks, referred to as "BACnet". ASHRAE developed BACnet to provide a method for diverse building automation devices to communicate and share data over a network.

1.2.2 ARCNET

ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.

1.2.3 BACnet

Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

1.2.4 BACnet/IP

An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number. See also "BACnet Broadcast Management Device".

1.2.5 BACnet Internetwork

Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

1.2.6 BACnet Network

One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

1.2.7 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.2.8 BBMD

BACnet Broadcast Management Device (BBMD).A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

1.2.9 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

1.2.10 BAS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical support, control parameters, and daily operation. The BAS Owner for this project is Department of Homeland Security (DHS).

1.2.11 BIBBs

BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices.The “A” device uses data provided by the "B" device, or requests an action from the “B” device.

1.2.12 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

1.2.13 BI/BTL

BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

1.2.14 Bridge

Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

1.2.15 Broadcast

A message sent to all devices on a network segment.

1.2.16 Device

Any control system component, usually a digital controller, that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

1.2.17 Device Object

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

1.2.18 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and

BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported.

1.2.19 Digital Controller

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device".

1.2.20 Direct Digital Control (DDC)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

1.2.21 DDC System

A network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

1.2.22 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media.

1.2.23 Firmware

Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

1.2.24 Gateway

Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

1.2.25 Half Router

A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

1.2.26 Hub

A common connection point for devices on a network.

1.2.27 Internet Protocol (IP, TCP/IP, UDP/IP)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying

and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

1.2.28 Input/Output (I/O)

Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

1.2.29 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.

1.2.30 IP subnet

Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

1.2.31 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.2.32 LonTalk

CEA-709.1-C. A communication protocol developed by Echelon Corp. LonTalk is an optional physical and data link layer for BACnet.

1.2.33 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

1.2.34 Master-Slave/Token-Passing (MS/TP)

ISO 8802-3. One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

1.2.35 Native BACnet Device

A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

1.2.36 Network

Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®.

1.2.37 Network Number

A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

1.2.38 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

1.2.39 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

1.2.40 Object Properties

Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

1.2.41 Peer-to-Peer

Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

1.2.42 Performance Verification Test (PVT)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

1.2.43 PID

Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

1.2.44 PICS

Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

1.2.45 Points

Physical and virtual inputs and outputs. See also "Input/Output".

1.2.46 PTP

Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

1.2.47 Repeater

A network component that connects two or more physical segments at the physical layer.

1.2.48 Router

A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

1.2.49 Stand-Alone Control

Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS profile) communicating on a network with a parent device are exempt from stand-alone requirements.

1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

The paragraph specifies that all contract requirements of this section shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

1.4 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

a. Remove existing and provide new BACnet DDC systems including associated equipment and accessories. All new devices are accessible using a Web browser interface and communicate using ASHRAE 135 BACnet communications without the use of gateways, unless gateways are shown on the design drawings and specifically requested by the Government. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.

1.4.1 Design Requirements

1.4.1.1 Control System Drawings Title Sheet

Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings.

1.4.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria.

1.4.1.3 Control System Components List

Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number.For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

1.4.1.4 Control System Schematics

Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

a. Location of each input and output device

b. Flow diagram for each piece of HVAC equipment

c. Name or symbol for each control system component, such as V-1 for a valve

d. Setpoints, with differential or proportional band values

e. Written sequence of operation for the HVAC equipment

f. Valve and Damper Schedules, with normal (power fail) position

1.4.1.5 HVAC Equipment Electrical Ladder Diagrams

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

1.4.1.6 Component Wiring Diagrams

Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

1.4.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

1.4.1.8 BACnet Communication Architecture Schematic

Provide a schematic showing the project's entire BACnet communication network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks.

1.5 SUBMITTALS

Submit the in accordance to Section 01 33 00 – SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Include the following in the project's control system drawing set:

Control system drawings title sheet;

List of I/O Points;

Control System Components List;

Control system schematics;

HVAC Equipment Electrical Ladder diagrams;

Component wiring diagrams;

Terminal strip diagrams;

BACnet communication architecture schematic;

SD-03 Product Data

Direct Digital Controllers;

Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

BACnet Gateways;

Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

BACnet Protocol Analyzer;

Include capability to store and report data traffic on BACnet networks, measure bandwidth usage, filter information, and identify BACnet devices.

DDC Software;

Sensors and Input Hardware;

Output Hardware;

Surge and transient protection;

Indicators;

SD-05 Design Data

Performance Verification Testing Plan;

Pre-Performance Verification Testing Checklist;

SD-06 Test Reports

Performance Verification Testing Report;

SD-07 Certificates

Contractor's Qualifications;

SD-09 Manufacturer's Field Reports

Pre-PVT Checklist;

SD-10 Operation and Maintenance Data

Comply with requirements for data packages in DIVISION 01 - GENERAL REQUIREMENTS except as supplemented and modified in this specification.

BACnet Direct Digital Control Systems, Data Package 4;

Controls System Operators Manuals, Data Package 4;

SD-11 Closeout Submittals

Training documentation;

1.6 QUALITY ASSURANCE

1.6.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

1.6.2 Delivery, Storage, and Handling

Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6.3 Operating Environment

Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

1.6.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

1.6.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

1.6.6 Contractor's Qualifications

Submit documentation certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years.

1.6.7 Modification of References

The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

1.6.8 Project Sequence

The control system work for this project shall proceed in the following order:

a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."

b. Perform the control system installation work, including all field check-outs and tuning.

c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."

d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."

e. Submit and receive approval of the Performance Verification Testing Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."

f. Perform the Performance Verification Testing.

g. Submit and receive approval on the PVT Report.

h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL".

i. Deliver the final Controls System Operators Manuals.

j. Conduct Training.

k. Submit and receive approval of Closeout Submittals.

PART 2 PRODUCTS

2.1 DDC SYSTEM

a. Provide a networked DDC system for stand-alone control in compliance with the latest revision of the ASHRAE 135 BACnet standard. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet communications between the DDC system and native BACnet devices furnished with HVAC equipment. Devices provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing.

2.1.1 Direct Digital Controllers

Direct digital controllers shall be UL 916 rated.

2.1.1.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller.

2.1.1.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

2.1.1.3 Stand-Alone Control

Provide stand-alone digital controllers.

2.1.1.4 Internal Clock

Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.1.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power

source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

2.1.1.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.1.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

2.1.1.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

2.1.1.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.

b. Binary Inputs: Binary inputs shall have a toggle switch and monitor on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.

c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.

d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.

e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.

f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.

g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

2.1.1.10 Digital Controller BACnet Internetwork

Provide a BACnet internetwork with control products, communication media, connectors, repeaters, hubs, and routers. Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE 135, BACnet. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.

2.1.1.11 Communications Ports

a. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.

b. Telecommunications Interface Port: Provide one telecommunication port per building, permitting remote communication via point-to-point (PTP) protocol over telephone lines.

2.1.1.12 Modems

Provide v.92 modems where required for communication between the BACnet Operator Workstation (B-OWS) and the DDC system.

2.1.1.13 BACnet Gateways

Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Provide with each gateway an interoperability schedule showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

The following minimum capabilities are required:

a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.

b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.

c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.

d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.

e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.1.1.14 Digital Controller Cabinet

Provide each digital controller in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

2.1.1.15 Main Power Switch and Receptacle

Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

2.1.2 DDC Software

2.1.2.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

a. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.

b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.

c. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.

d. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

2.1.2.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

2.1.2.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

2.1.2.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

2.1.2.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

2.1.2.6 Timed Local Override

Provide an adjustable override time for each push of a timed local override button.

2.1.2.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

2.1.2.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

2.1.2.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out-Of-Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

2.1.2.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. When a computer workstation or web server is connected to the BACnet internetwork, alarms/events shall report to the computer, printer, alphanumeric pager, as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device and retrieved. Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

2.1.2.11 Trending

Provide BACnet trend services capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

The operator workstation shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification_Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the workstation and connected notebook computers.

2.1.2.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

2.1.2.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.1.3 BACnet Protocol Analyzer

Provide a BACnet protocol analyzer and required cables and fittings for connection to the BACnet network. The analyzer shall include the following minimum capabilities:

a. Capture and store to a file data traffic on all network levels.

b. Measure bandwidth usage.

c. Filtering options with ability to ignore select traffic.

2.2 SENSORS AND INPUT HARDWARE

Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

2.2.1 Field-Installed Temperature Sensors

Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2.2.1.1 Thermistors

Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.

2.2.1.3 Temperature Sensor Details

a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button with LED status indication, setpoint adjustment lever, without temperature display. Provide a hidden communication port or 802.11x wireless support for a portable operator interface like a notebook computer or PDA.

b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.

c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.

d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.

e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.2.2 Transmitters

Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

2.2.2.1 Relative Humidity Transmitters

Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

2.2.2.2 Pressure Transmitters

Provide transmitters integral with the pressure transducer.

2.2.3 Current Transducers

Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

2.2.4 Pneumatic to Electric Transducers

Pneumatic to electronic transducers shall convert a 0 to 20 psig signal to a proportional 4 to 20 mA or 0 to 10 VDC signal (operator scaleable). Supply voltage shall be 24 VDC. Accuracy and linearity shall be 1.0 percent or better.

2.2.5 Air Quality Sensors

Provide power supply for each sensor.

2.2.5.1 CO2 Sensors

Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

2.2.5.2 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and

calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.2.6 Input Switches

2.2.6.1 Timed Local Overrides

Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.2.7 Freeze Protection Thermostats

Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.2.8 Air Flow Measurement Stations

Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.2.9 Energy Metering

2.2.9.1 Electric Meters

Provide kilowatt-hour (kWh) meter(s) shown in accordance with NEMA/ANSI C12.10, suitable for the intended voltage, phases, and wye/delta configuration, with three current transformers and an output signal compatible with the DDC system.The meter shall have a box-mounted socket and an automatic circuit-closing bypass. Provide the meter with at least four pointer-type kWh registers, provisions for pulse initiation, and universal Class 2 indicating maximum kW demand register, sweep pointer indicating type, and a 15 minute interval. The meter accuracy shall be within plus or minus one percent of the actual kWh. Provide the correct multiplier on the meter face. Provide the current transformers in accordance with IEEE C57.13, with 600-volt insulation, and rated for metering with voltage, IL, momentary, and burden ratings coordinated with

the ratings of corresponding meters. Provide butyl-molded donut or window type transformers mounted on a bracket to allow secondary cables to connect to the transformer bushings. Provide wiring identification of the current transformer secondary feeders to permit field measurements to be taken with hook-on ammeters.

2.3 OUTPUT HARDWARE

2.3.1 Control Dampers

Provide factory manufactured galvanized steel dampers where indicated. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

Provide damper assembly frames constructed of 0.064 inch minimum thickness galvanized steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork subject to above 3-inch water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

Frames shall be at least 2 inches wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

The leakage rate of each damper when full-closed shall be no more than 4 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.3.2 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

2.3.2.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Thermal type actuators may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

2.3.3 Output Switches

2.3.3.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.4 ELECTRICAL POWER AND DISTRIBUTION

2.4.1 Transformers

Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

2.4.2 Surge and Transient Protection

Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.

b. The device shall react within 5 nanoseconds and automatically reset.

c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.

d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.

e. The primary suppression system components shall be pure silicon avalanche diodes.

f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.

g. The device shall have an indication light to indicate the protection components are functioning.

h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.

i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.

j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.

k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

2.4.2.2 Telephone and Communication Line Surge Protection

Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:

a. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.

b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.

c. The device shall be installed at the distance recommended by its manufacturer.

2.4.2.3 Controller Input/Output Protection

Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with DIVISION 26 - ELECTRICAL. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork.

2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.

b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

2.4.3.2 Analog Signal Wiring

Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair.Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

2.5 FIRE PROTECTION DEVICES

2.5.1 Duct Smoke Detectors

Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Provide UL listed or FM approved detectors, designed specifically for duct installation.

Furnish detectors under DIVISION 28 - ELECTRONIC SAFETY AND SECURITY and install under this section. Connect new detectors to the building fire alarm panel.

2.6 INDICATORS

2.6.1 Thermometers

Provide bi-metal type thermometers at locations shown. Thermometers shall have either 9 inch long scales or 3.5 inch diameter dials, with insertion, immersion, or averaging elements. Provide matching thermowells for pipe-mounted installations. Select scale ranges suitable for the intended service, with the normal operating temperature near the scale's midpoint. The thermometer's accuracy shall be plus or minus 2 percent of the scale range.

2.6.2 Pressure Gauges for Piping Systems

Provide pipe-mounted pressure gauges at the locations shown. Gauges shall conform to ASME B40.100 and have a 4-inch diameter dial and shutoff cock. Provide gauges in steam piping with a pressure snubber pigtail fitting. Select scale ranges suitable for the intended service, with the normal operating pressure near the scale's midpoint. The gauge's accuracy shall be plus or minus 2 percent of the scale range.

PART 3 EXECUTION

3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

3.1.1 BACnet Naming and Addressing

Coordinate with the BAS Owner and provide unique naming and addressing for BACnet networks and devices.

a. MAC Address

Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 00 to 64.

b. Network Numbering

Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object_Name" property names with plain-English descriptive names for each device
For example, the Device Object Name that for the device controlling the chiller plant at Building 3408 would be:

Device Object_Name = CW System B3408

A Device Object Name for a VAV box controller might be:

Device Object_Name = VAV BOX25

e. Object Name Property Text (Other than Device Objects)

The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

f. Object Identifier Property Number (Other than Device Objects)

Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

3.1.2 Minimum BACnet Object Requirements

a. Use of Standard BACnet Objects

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:
all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

Support and provide Description and/or Device_Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

Support and provide Inactive_Text and Active_Text property descriptions matching conditions shown on the points list.

e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

3.1.3 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

Priority Level	Application
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

b. Alarming

(1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.

(2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.

(3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

3.1.4 Local Area Networks

Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks.Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

3.1.5 BACnet Routers, Bridges, and Switches

Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an IP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment.

3.1.6 Wiring Criteria

a. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.

b. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.

c. Provide circuit and wiring protection required by NFPA 70.

d. Run all wiring located inside mechanical rooms in conduit.

e. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.

f. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination.

Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.

g. For controller power, provide new 120 VAC circuits, with ground. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.

h. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.

i. Grounding: Ground controllers and cabinets to a good earth ground as specified in DIVISION 26 - ELECTRICAL. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.

j. The Contractor shall be responsible for correcting all associated ground loop problems.

k. Run wiring in panel enclosures in covered wire track.

3.1.7 Accessibility

Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

3.1.8 Digital Controllers

a. Install as stand alone control devices (see definitions).

b. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

3.1.9 Hand-Off-Auto Switches

Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

3.1.10 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

3.1.10.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 54 inches above the floor to meet ADA requirements.

3.1.10.2 Duct Temperature Sensors

a. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.

b. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

3.1.10.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

3.1.10.4 Outside Air Temperature Sensors

Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

3.1.11 Energy Meters

Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

3.1.12 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

3.1.13 Thermometers and Gages

Mount devices to allow reading while standing on the floor or ground, as applicable.

3.1.14 Pressure Sensors

Locate pressure sensors as indicated.

3.1.15 Component Identification Labeling

Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

3.1.16 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 60 days advance notice of need.

3.2 TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING. This support shall include:

a. On-site operation and manipulation of control systems during the testing and balancing.

b. Control setpoint adjustments for balancing all relevant mechanical systems, including VAV boxes.

c. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.3 CONTROLS SYSTEM OPERATORS MANUALS

Provide one electronic and printed copy of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

a. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.

b. A copy of the project's mechanical design drawings, including any official modifications and revisions.

c. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."

d. A copy of the project's approved Performance Verification Testing Plan and Report.

e. A copy of the project's approved final TAB Report.

f. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.

g. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.

h. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.

i. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.

j. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.

k. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.

l. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

3.4 PERFORMANCE VERIFICATION TESTING (PVT)

3.4.1 General

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Government. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the BAS Owner.

3.4.2 Performance Verification Testing Plan

Submit a detailed PVT Plan of the proposed testing for Government approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be an clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project's sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the BAS Owner to acknowledge successful completion.

3.4.3 PVT Sample Size

Test all central plant equipment and primary air handling unit controllers unless otherwise directed. Twenty percent sample testing is allowed for identical controllers typical of terminal control like VAV boxes and fan coil units. The Government may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

The Government may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Government may choose which ones.

3.4.4 Pre-Performance Verification Testing Checklist

Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

b. Verify HVAC motors operate below full-load amperage ratings.

c. Verify all required control system components, wiring, and accessories are installed.

d. Verify the installed control system architecture matches approved drawings.

e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.

f. Verify all required surge protection is installed.

g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.

h. Verify all DDC network communications function properly, including uploading and downloading programming changes.

i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.

j. Verify each digital controller’s programming is backed up.

k. Verify all wiring, components, and panels are properly labeled.

l. Verify all required points are programmed into devices.

m. Verify all TAB work affecting controls is complete.

n. Verify all valve and actuator zero and span adjustments are set properly.

o. Verify all sensor readings are accurate and calibrated.

p. Verify each control valve and actuator goes to normal position upon loss of power.

q. Verify all control loops are tuned for smooth and stable operation. View trend data where applicable.

r. Verify each controller works properly in stand-alone mode.

s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.

t. Verify all electrical interlocks work properly.

u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook.

v. Verify the as-built (shop) control drawings are completed.

3.4.5 Conducting Performance Verification Testing

a. Conduct Government-witnessed PVT after approval of the PVT Plan and the completed Pre-PVT Checklist. Notify the Contracting Officer of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's

mechanical design drawings, the approved Pre-PVT Checklist, and the approved PVT Plan, conduct the PVT.

b. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.

c. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

3.4.6 Controller Capability and Labeling

Test the following for each controller:

a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.

b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.

c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network.

d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.

e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

3.4.7 Workstation and Software Operation

For every user workstation or notebook provided:

a. Show points lists agree with naming conventions.

b. Show that graphics are complete.

c. Show the UPS operates as specified.

3.4.8 BACnet Communications and Interoperability Areas

Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying

interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.

b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.

c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.

d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.

e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).

f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.

g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.

h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.

i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.

j. Device and Network Management: Show the following capabilities:

   (1) Display of Device Status Information

   (2) Display of BACnet Object Information

   (3) Silencing Devices that are Transmitting Erroneous Data

   (4) Time Synchronization

(5) Remote Device Reinitialization

(6) Backup and Restore Device Programming and Master Database(s)

(7) Configuration Management of Half-Routers, Routers and BBMDs

3.4.9 Execution of Sequence of Operation

Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

3.4.10 Control Loop Stability and Accuracy

For all control loops tested, give the Government trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

3.4.11 Performance Verification Testing Report

Upon successful completion of the PVT, submit a PVT Report to the Government and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

3.5 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location.

-- End of Section --

SECTION 23 81 00.00 20

UNITARY AIR CONDITIONING EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI DCUP	(Online) Directory of Certified Unitary Products
ANSI/AHRI 460	(2005) Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ANSI/ASHRAE 15 & 34	(2010; Addenda a, b, c, d, e, f, g, h, I, j, k, l, n and o; Errata 2011) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
ASHRAE 52.2	(2007; Addenda B 2008; Errata 2009, Errata 2010; INT 2010; Errata 2011) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 55	(2010; Errata 1 2011; Addenda A 2011) Thermal Environmental Conditions for Human Occupancy
ASHRAE 62.1	(2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D 520	(2000; R 2005) Zinc Dust Pigment

ASTM F 1040	(1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA MG 1	(2009) Motors and Generators

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-5541	(2006; Rev F) Chemical Conversion Coatings on Aluminum and Aluminum Alloys

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50502	(Basic) Air Conditioners, (Unitary Heat Pump), Air to Air (3,000 to 300,000 BTU)
FS OO-A-374	(Rev C) Air Conditioners with Remote Condensing Units or Remote Air-Cooled, and Water-Cooled Condenser Units, Unitary

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

UNDERWRITERS LABORATORIES (UL)

UL 1995	(2005; R 2009) Heating and Cooling Equipment
UL 873	(2007; Reprint Jan 2010) Standard for Temperature-Indicating and -Regulating Equipment
UL 900	(2004; Reprint Nov 2009) Standard for Air Filter Units

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control system wiring diagrams

SD-03 Product Data

Condensing Units

Heat pumps, air to air

Air conditioners

Submit documentation for Energy Star qualifications or meeting FEMP requirements. Indicate Energy Efficiency Rating. For packaged terminal units, include indoor noise rating.

Filters

Thermostats

SD-06 Test Reports

Start-up and initial operational tests

SD-08 Manufacturer's Instructions

Heat pumps, air to air

Condensing Units

Air conditioners

Filters

Thermostats

SD-10 Operation and Maintenance Data

Condensing Units

Heat pumps, air to air,

Air conditioners,

Filters,

Thermostats,

Submit in accordance with DIVISION 01 - GENERAL REQUIREMENTS.

SD-11 Closeout Submittals

Posted operating instructions

1.4 QUALITY ASSURANCE

1.4.1 Modification of References

Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Contracting Officer.

1.4.2 Detail Drawing

For refrigerant piping, submit piping, including pipe sizes. Submit control system wiring diagrams.

1.4.3 Safety

Design, manufacture, and installation of unitary air conditioning equipment shall conform to ANSI/ASHRAE 15 & 34.

1.4.4 Posted Operating Instructions

Submit posted operating instructions for each packaged air conditioning unit.

1.4.5 Sizing

Size equipment based on Design Manual CS from the Air Conditioning Contractors of America; do not oversize.

1.5 REFRIGERANTS

Refrigerants shall have an Ozone Depletion Factor (ODF) of 0.05 or less. The ODF shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Programme. CFCs and HCFCs and Halons shall not be permitted. Refrigerant shall be an approved alternative refrigerant per EPA's Significant New Alternative Policy (SNAP) listing.

1.6 ENVIRONMENTAL REQUIREMENTS

For proper Indoor Environmental Quality, maintain positive pressure within the building. Ventilation shall meet or exceed ASHRAE 62.1 and all published addenda. Meet or exceed filter media efficiency as tested in accordance with ASHRAE 52.2. Thermal comfort shall meet or exceed ASHRAE 55.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Local/Regional Materials

See Division 01 - for Sustainable Design Requirements.

1.7.2 Environmental Data

See Division 01 for Environmental Requirements.

PART 2 PRODUCTS

2.1 CONDENSING UNITS

Each remote condenser coil shall be fitted with a manual isolation valve and an access valve on the coil side. Saturated refrigerant condensing temperature shall not exceed 120 degrees F at 95 degrees F ambient. Unit shall be provided with low ambient condenser controls to ensure proper operation in an ambient temperature of 0 degrees F. Fan and cabinet construction shall be provided as specified in paragraph "Unitary Equipment Components". Fan and condenser motors shall have open enclosed enclosures.

2.1.1 Energy Performance

Energy performance shall be in accordance with CID A-A-50502 and schedules on plans.

2.1.2 Air-Cooled Condenser

Unit shall be rated in accordance with ANSI/AHRI 460 and conform to the requirements of UL 1995. Unit shall be factory fabricated, tested, packaged, and self-contained. Unit shall be complete with casing, propeller or centrifugal type fans, heat rejection coils, connecting piping and wiring, and all necessary appurtenances.

2.1.2.1 Connections

Interconnecting refrigeration piping, electrical power, and control wiring between the condensing unit and the indoor unit shall be provided as required and as indicated. Electrical and refrigeration piping terminal connections between condensing unit and evaporator units shall be provided.

2.2 HEAT PUMPS, AIR TO AIR

CID A-A-50502, except as modified in this article; Type II, Class 18r2. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the ARI Directory, a letter of certification from ARI that the units have been certified and will be listed in the next Directory will be acceptable. Provide factory assembled units complete with accessories, wiring, piping, and controls. Provide units with outlet grilles, supplemental electric heaters, humidifiers, and air filters as specified in the paragraph entitled "Filters." Units shall be provided with low ambient operation condenser controls to ensure proper operation in an ambient temperature of 0 degrees F.

2.2.1 Energy Performance

Energy performance shall be in accordance with CID A-A-50502 schedules on plans.

2.2.2 Air Coils

Extended-surface fin and tube type with seamless copper or aluminum tubes with copper or aluminum fins securely bonded to the tubes. On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a coating on outdoor air and indoor air coils as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.2.3 Compressors

For compressors above 20 tons, compressor speed shall not exceed 3450 rpm. For equipment over 10 tons, provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have a means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shutdown by safety controls. Provide reciprocating compressors with crankcase heaters, and vibration isolators.

2.2.4 Mounting Provisions

Provide units that permit mounting as indicated. Provide suitable lifting attachment plates to enable equipment to be lifted to normal position.

2.2.5 Temperature Controls

Provide controls as specified in CID A-A-50502 and as modified herein. Provide indoor thermostats of the adjustable type that conform to applicable requirements of UL 873. Provide manual means for temperature set-back. Provide thermostats capable of controlling supplemental heat as specified in CID A-A-50502. Provide a manual selector switch or other means to permit the supplementary heater to be energized when the heat pump compressor and associated equipment are inoperative. Control supplementary heater with the room thermostat while bypassing the outdoor thermostat. Locate switch adjacent to or as an integral part of the room thermostat. An indicator light on the room thermostat or manual heat switch shall indicate when supplementary heaters are operating.

2.2.6 Accessories

In addition to accessories specified in CID A-A-50502, provide the following accessories for heat pump units.

a. Protective grille around outside unit coils

2.3 AIR CONDITIONERS

2.3.1 Split-System Type

FS OO-A-374, except as modified herein; Type I, Style A, B & C, Class 1. Additional requirements for various system components are specified in this paragraph; however, basic requirements for the system and system components

are contained in FS OO-A-374. Provide separate assemblies designed to be used together. Base ratings on the use of matched assemblies. Provide performance diagrams for units with capacities not certified by ARI to verify that components of the air conditioning system furnished will satisfy the capacity requirement specified or indicated. Minimum energy efficiency shall be in accordance with ASHRAE 90.1 - IP, at a minimum or in accordance with schedules on plans. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the ARI Directory, a letter of certification from ARI that units have been certified and will be listed in the next Directory will be acceptable. Provide capacity, electrical characteristics and operating conditions as indicated. Condensers shall provide not less than 10 degrees F liquid subcooling at standard ratings.

2.3.2 Single Zone Units

Provide single zone type units arranged to draw or blow through coil sections. Air may be blown or drawn through heating section.

2.3.3 Heaters

Provide as an integral part of the evaporator-blower unit.

2.3.4 Compressors

For compressors over 20 tons, compressor speed shall not exceed 3450 rpm. For systems over 10 tons provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multi- or variable speed compressors, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shut down by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes. Provide a pumpdown cycle for units 20 tons and over. Provide reciprocating compressors with crankcase heaters in accordance with the manufacturer's recommendations. If compressors are paralleled, provide not less than two independent circuits.

2.3.5 Coils

On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation. Provide a coating on condenser and evaporator coils and fins as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.3.6 Condenser Controls

Provide start-up and head pressure controls to allow for system operation at ambient temperatures down to 0 degrees F.

2.3.7 Fans

Provide belt-driven evaporator fans with adjustable pitch pulleys; except for units less than 5 ton capacity, direct drive with at least two speed taps may be used. Select pulleys at approximately midpoint of the adjustable range.

2.3.8 Filters

Provide filters of the type specified in this section.

2.3.9 Filter Boxes

Provide when filters are not included integral with air conditioning units. Construct of not less than No. 20 US gage steel with track, hinged access doors with latches, and gaskets between frame and filters. Arrange filters to filter outside and return air. Provide removable filter assemblies, replaceable without the use of tools.

2.3.10 Mixing Boxes

Provide of the physical size to match the basic unit and include equal sized flanged openings, sized to individually handle full air flow. Arrange openings as indicated. Provide openings with dampers of parallel or opposed blade type. Provide opposed blade type for modulating dampers and parallel type for two-position dampers. Connect damper shafts together by one continuous linkage bar. Arrange dampers for manual operation so that when one starts to close from its opened position, the other starts to open from its closed position.

2.3.11 Thermostats

Provide adjustable type that conforms to applicable requirements of UL 873. Provide combination heating-cooling type with contacts hermetically sealed against moisture, corrosion, lint, dust, and foreign material. Design to operate on not more than 1.5 degrees Fdifferential and of suitable range calibrated in degrees F. Provide adjustable heat anticipation and fixed cooling anticipation. Provide two independent temperature sensing elements electrically connected to control the compressor and heating equipment, respectively. Accomplish manual switching for system changeover from heating to cooling or cooling to heating and fan operation through the use of a thermostat subbase. Provide system selector switches to provide "COOL" and "OFF" and "HEAT" and fan selector switches to provide "AUTOMATIC" and "ON." Provide relays, contactors, and transformers located in a panel or panels for replacement and service.

2.3.11.1 Cooling

a. When thermostat is in "COOL" position with fan selector switch in "AUTO" position, compressor, evaporator fan, and condenser fan shall cycle together.

b. When thermostat is in "COOL" position with fan selector switch in "ON" position, compressor, and condenser fan shall cycle together and evaporator fan shall run continuously.

2.3.11.2 Heating

a. When thermostat is in "HEAT" position with fan selector switch in "AUTO" position, heater and supply air fan shall cycle together. Provide a separate thermostat to keep the fan running until the heater cools.

b. When thermostat is in "HEAT" position with fan selector switch in "ON" position, heater shall cycle and supply air fan shall run continuously.

2.3.11.3 Supply Air Fan

a. When fan selector switch is in "AUTO" position with thermostat in "OFF" position, fan shall not run.

b. When fan selector switch is in "ON" position, fan shall run continuously.

2.4 FILTERS

Provide filters to filter outside air and return air and locate inside air conditioners. Provide replaceable (throw-away) type. Filters shall conform to UL 900, Class 2. Polyurethane filters shall not be used on units with multiframe filters.

2.4.1 Replaceable Type Filters

ASTM F 1040 throw-away frames and media, standard dust holding capacity, 350 fpm maximum face velocity, and 2 inches thick. Filters shall have a minimum efficiency reporting value (MERV) of 8 when tested in accordance with ASHRAE 52.2.

2.5 FINISHES

2.5.1 Factory Coating

2.5.1.1 Equipment and Components

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 125 hours exposure to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type 1.

2.5.2 Chemical Conversion Coating with Polyelastomer Finish Coat

Dip coils in a chemical conversion solution to molecularly deposit a corrosion resistant coating by electrolysis action. Chemical conversion coatings shall conform to MIL-DTL-5541, Class 1A.Cure conversion coating at a temperature of 110 to 140 degrees F for a minimum of 3 hours. Coat coil surfaces with a complex polymer primer with a dry film thickness of 1 mil. Cure primer coat for a minimum of 1 hour. Using dip tank method, provide three coats of a complex polyelastomer finish coat. After each of the first two finish coats, cure the coils for 1 hour. Following the third

coat, spray a fog coat of an inert sealer on the coil surfaces. Total dry film thickness shall be 2.5 to 3.0 mils. Cure finish coat for a minimum of 3 hours. Coating materials shall have 300 percent flexibility, operate in temperatures of minus 50 to plus 220 degrees F, and protect against atmospheres of a pH range of 1 to 14.

2.6 MOTORS AND STARTERS

NEMA MG 1, NEMA ICS 1, and NEMA ICS 2. Variable speed. Motors less than 1 hp shall meet NEMA High Efficiency requirements. Motors 1 hp and larger shall meet NEMA Premium Efficiency requirements. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide general-purpose type starter enclosures in accordance with NEMA ICS 6.

2.7 REFRIGERANT PIPING

Refrigerant piping for split-system unitary equipment shall be provided and installed in accordance with Section 23 23 00 REFRIGERANT PIPING.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

3.1.1 Unitary Air Conditioning System

Install as indicated, in accordance with requirements of ANSI/ASHRAE 15 & 34, and the manufacturer's installation and operational instructions.

3.2 AUXILIARY DRAIN PANS, DRAIN CONNECTIONS, AND DRAIN LINES

Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment where condensate overflow will cause damage to ceilings, piping, and equipment below. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.3 ACCESS PANELS

Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.4 AIR FILTERS

Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air.

3.5 FLASHING AND PITCH POCKETS

Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls in accordance with Section 07 60 00 FLASHING AND SHEET METAL.

3.6 IDENTIFICATION TAGS AND PLATES

Provide equipment, gages, thermometers, valves, and controllers with tags numbered and stamped for their use. Provide plates and tags of brass or suitable nonferrous material, securely mounted or attached. Provide minimum letter and numeral size of 1/8 inch high.

3.7 FIELD QUALITY CONTROL

3.7.1 Start-Up and Initial Operational Tests

Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

3.7.2 Performance Tests

Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, test the systems to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, record readings hourly. At the end of the test period, average the readings, and the average shall be considered to be the system performance.

3.8 WASTE MANAGEMENT

Separate waste in accordance with the Waste Management Plan, placing copper materials in designated areas for reuse. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

-- End of Section --

SECTION 23 82 00.00 20

TERMINAL HEATING UNITS

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2006) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 54	(2006) National Fuel Gas Code
NFPA 70	(2007) National Electrical Code - 2008 Edition
NFPA 90A	(2002; Errata 2003; Errata 2005) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2006) Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	(2004) Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Unit heaters;

Infrared heaters;

SD-10 Operation and Maintenance Data

Unit heaters,

Infrared heaters

PART 2 PRODUCTS

2.1 UNIT HEATERS

Self-contained and factory assembled, propeller or centrifugal fan with capacities expressed as Btu per hour output and cubic foot-per-minute air delivery, operating conditions, and mounting arrangements as indicated. Average fan bearing life shall be minimum 200,000 hours at operating conditions. Provide fan motor with direct or belt drive. Construct fan-guard motor mount of steel wire. Equip each heater with individually adjustable package discharge louver. Provide thermostats as indicated. Furnish circuit breaker disconnect switch.

2.1.1 Electric Unit Heater

UL listed; wattage, voltage, phase, and number of steps as indicated. Provide control-circuit terminals and single source of power supply. Heater 5 Kw and larger shall be three-phase, with load balanced on each of the three phases. Limit leaving air temperature below 140 degrees F at 60 degrees F entering air.

2.1.1.1 Casing

Minimum 21 gage steel.

2.1.1.2 Heating Element

Nickel-chromium heating wire element, free from expansion noise and 60 Hz hum. Embed element in magnesium-oxide insulating refractory. Seal element in high-mass steel or corrosion-resisting metallic sheath with fins. Enclose element ends in terminal box. Space fins at maximum six fins per inch. Limit fin surface temperature 550 degrees Fat any point during normal operation.

2.1.1.3 Controls

Include limit controls for thermal overheat protection of heaters. For remote thermostatic operation, provide contactor rated for 100,000 duty cycles. Provide a control transformer to supply 120-volt thermostat control circuit for each heater. Provide room thermostat for pilot duty.

2.1.1.4 Wiring

Completely factory-prewired to terminal strips, ready to receive branch circuit and control connections for 140 degrees Faluminum wiring.

2.1.1.5 Accessories

Provide fan switching devices to independently operate fan motor for summer ventilation and winter heat recovery.

2.2 INFRARED HEATERS

Reflector-beam spread and operating conditions as indicated. Provide pre-wired control boxes, thermostats, reflector and duct hangers.

2.2.1 Electric Infrared Heater

Self-contained, factory assembled, and UL listed and including the heating element, reflector, heater housing, mounting brackets, element holders, wire guards, and high-temperature internal wiring.

2.2.1.1 Heating Element

Minimum 3/8 inch diameter quartz tube or metal sheath with coiled resistor wire. Element operating temperature range shall be 1200 to 1800 degrees F.

2.2.1.2 Heater Housing

Weatherproof stainless-steel construction. Provide a baked enamel finish over a corrosion-resistant primer. Provide a chrome-plated or stainless-steel wire guard to prevent heating elements from accidental damage. Furnish swivel brackets to position heater in any horizontal angle.

2.2.1.3 Reflector

Polished stainless steel.

2.2.1.4 Wiring

Fully enclosed internal wiring. Provide minimum 24 inchslack fixture (heater) wire for connection to branch circuit wiring.

2.3 SOURCE QUALITY CONTROL

Protect equipment items by manufacturers' corrosion-inhibiting coating or paint system that has proved capable of withstanding salt-spray test in accordance with ASTM B 117. Test indoor and outdoor equipment for 125 hours; test outdoor equipment used in a marine atmosphere for 500 hours. For each specimen, perform a scratch test as defined in ASTM D 1654.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment where indicated and as recommended by manufacturer's recommendations, NFPA 54, NFPA 90A, NFPA 90B, NFPA 91 and NFPA 211.

3.1.1 Suspensions of Equipment

Provide equipment supports including beam clamps, turnbuckles and twist links or weld-wire chains, wire ropes with rope clips and rope thimbles, threaded-eye rod hangers with lock nuts and heat-duct hangers, threaded-eye bolts with expansion screws, brackets, platform and mounting frame, and vibration isolators.Locate equipment in such a manner that working space is available for servicing, such as vacuum pump and burner removal, access to automatic controls, and lubrication. Provide electrical isolation of dissimilar metals. Clean interior of casings or cabinets before and after completion of installation.

3.1.2 Electrical Work

NFPA 70 and Division 16, "Electrical Work." When replacing original control wires, provide No. 16 AWG with minimum 105 degrees C insulation.

3.2 FIELD QUALITY CONTROL

Administer, schedule, and conduct specified tests. Furnish personnel, instruments and equipment for such tests. Correct defects and repeat the respective inspections and tests. Conduct inspections and testing in the presence of the Contracting Officer's Technical Representative.

3.2.1 Test Instruments and Apparatus

Provide instruments and apparatus currently certified as being accurate to within one percent of their full scale. Use gages with a maximum scale between 1 1/2 and 2 times test pressure.

3.2.2 Field Inspection

Prior to initial operation, inspect equipment installation to ensure that indicated and specified requirements have been met.

3.2.3 Field Tests

3.2.3.1 Insulation-Resistance Tests for Electrical Equipment

At the completion of wiring, test 600 volt wiring to verify that no short circuits exist before or after the attachment of electrical heating equipment to the power source. Make tests with an instrument which applies a voltage of approximately 500 volts for a direct reading of insulation resistance.

3.2.3.2 Operational Tests

After completing fire tests and insulation-resistance tests, operate equipment continuously under varying load conditions to verify functioning of combustion controls, electrical controls, flame safeguard controls, safety interlocks, and specified operating sequence. Run each test for a minimum period of one hour.

-- End of Section --

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. This section applies to all sections of Division 26, ELECTRICAL, of this project specification unless specified otherwise in the individual sections.This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM
Section 26 23 00 SWITCHBOARDS AND SWITCHGEAR
Section 26 51 00 INTERIOR LIGHTING
Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment

operations and that refer to this section for detailed description of submittal types.

c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 480/277 volts, three phase, four wire service to the main switchboard. The switchboard will supply the 480/277 volt distribution panelboards, which in turn supply dry type stepdown transformers and their associated 208/120 volt and 240/120 volt panelboards.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

When required by a task order, include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial

market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.

1.6.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

When required by a task order, provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.12 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in the task order, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the task order.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements specified in the technical sections.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS the section specifying the associated electrical equipment.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

-- End of Section --

26 08 16

COMMISSIONING OF ELECTRICAL SYSTEMS SUPPORT

PART 1 GENERAL

1.1 SCOPE OF ELECTRICAL SUPPORT

A. The purpose of this section is to specify Division 26, 27 and 28 responsibilities and participation in the commissioning process if commissioning services are specifically required by a task order.

B. The Owner has established a Commissioning Authority (CxA) to oversee certain commissioning activities on this project. While the CxA has the overall responsibility for planning and coordinating the commissioning process, all parties participate. This includes the owner, construction manager, facility operator, architect, engineer, general contractor, subcontractors, specialty subcontractors, equipment suppliers, vendors, building authorities and others entities as required.

C. If required by a task order, the General Contractor and all Subcontractors shall designate one person to represent their own company as the full-time Lead Commissioning Coordinator. Each Lead Commissioning Coordinator shall participate as a member of the Commissioning Authority's 'Commissioning Team'. The General Contractor and each Subcontractor shall also designate a backup person to represent their company and fill the role as Lead Commissioning Coordinator and participate as a member of the CxA Commissioning Team when there are absences.

D. Commissioning and coordination with the Commissioning Authority are the responsibility of the Contractor (including subcontractors and vendors). The Contractor is responsible for providing all scheduling, coordination and support required for start-up, testing, and commissioning (see Division 01). The General Commissioning Requirements Section 01 19 13 is intended to provide an indication of the systems which are to be commissioned by the Contractor prior to and including verification by the Owner's Representative. The commissioning process requires Division 26, 27 and 28 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner.

E. Work of Divisions 26, 27, and 28 include the following:

1. Attend commissioning scoping meetings. Equipment vendor representatives shall also attend upon request of the Commissioning Authority. These meetings shall further define the testing requirements and participation of each contractor and sub-contractors for each commissioning activity.

2. Attend commissioning meetings as required to facilitate the commissioning process.

3. Provide Commissioning Authority additional requested data, prior to normal O&M Manual submittal, in a timely manner for the development of the pre-functional and functional performance testing procedures.

4. During the normal submittal processes, provide an additional copy of all equipment submittals, startup forms, field static testing reports (Circuit breaker test report, Megger test reports, Torque testing reports, etc.) to the Commissioning Authority for review.

5. The Electrical Prime Contractor shall be responsible for development of a comprehensive startup plan. The startup plan shall be developed with the help of the Commissioning Authority in order to integrate startup activities with the Commissioning Authority's commissioning plan.

6. The Commissioning Authority shall prepare the Pre-Functional Checklists (PFC) and Functional Performance Test (FPT) checklists. The PFC & FPT checklists shall be completed after equipment submittals have been reviewed, and then distributed the Contractor.

7. Provide skilled technicians, including equipment vendor representatives, equipment, and materials to perform pre-functional testing and execute functional performance tests.

8. Correct deficiencies found during startup and functional performance testing in a timely manner to facilitate retesting activities within the commissioning schedule.

9. Submit the completed Pre-Functional Checklists to General Contractor, and Commissioning Authority to verify pre-functional requirements are fulfilled before functional performance testing for the associated equipment or system is scheduled to start. Refer to Section "01 91 13 - General Commissioning Requirements," for commissioning procedure detail. Startup documentation shall also be required from as a prerequisite to functional performance testing.

10. Maintain and update as-built drawings during construction.

11. Provide final O&M manuals that incorporate all system changes.

12. Providing training, for equipment and systems specified under this section, with coordination by the Contractor and Owner's Representative

1.2 RELATED WORK

A. Division 01 Section 01 91 13 General Commissioning Requirements.

B. Division 26 Electrical.

C. Division 27 Communications

D. Cooperate with the Mechanical contractor in the following manner:

1. Provide necessary power to allow mechanical equipment start up to be accomplished according to the master schedule.

2. Provide labor and material to make corrections when required, without undue delay.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide test equipment as necessary for start-up and commissioning of the electrical equipment and systems.

B. Proprietary test equipment required by the electrical equipment manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall demonstrate its use and assist the Contractor in the commissioning process.

PART 3 EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so each system can be started, tested, and otherwise commissioned. Division 28 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are fully functional. This includes the complete installation of all equipment, materials, conduit, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.

B. A commissioning plan will be developed by the Commissioning Authority and approved by the Owner's Representative.

1. Division 28 shall be obligated to assist the Commissioning Authority in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation, identification of electrical commissioning support person, parties responsible for startup activities, and schedule dates for equipment startup activities.

2. If system modifications/clarifications are called for in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.

3. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner's Representative for approval.

3.2 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up all systems within Division 28.

1. These same technicians shall be made available to assist the Contractor and Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty.

2. Work schedules, time required for testing, etc., will be requested and coordinated by the Contractor.

3. Division 28 will ensure that qualified technician(s) are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustment, and problem resolutions.

B. System problems and discrepancies may require additional technician time which shall be made available for the subsequent commissioning periods until required system performance is obtained.

C. The Owner's Representative reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Such qualifications include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Contractor to get the job done.

3.3 WORK TO RESOLVE DEFICIENCIES

A. In some systems, misadjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Owner's Representative and the Architect, with input from the Contractor and equipment supplier. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the work needed to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problem in an expeditious manner will be the Contractor's responsibility.

3.4 RETESTING AND RECOMMISSIONING

Any fault in material or in any part of the installation revealed by commissioning tests shall be investigated, replaced, or repaired by the Contractor, and the same test repeated at the Contractor's expense until no fault appears.

3.5 TRAINING

A. Participate in the training of the Owner's engineering and maintenance staff, as required in Divisions 01 and 28, on each system and related components. Training, in part, will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.

B. Training shall be conducted jointly by the Contractor, the Design Engineers, and the equipment vendors. The Contractor will be responsible for highlighting system peculiarities specific to this project.

-- End of Section --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012) National Electrical Safety Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2005) American National Standard for Electrical Metallic Tubing (EMT)
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FU 1	(2002; R 2007) Low Voltage Cartridge Fuses

NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2010) Terminal Blocks
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2009) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(1992; R 1997) Standard for Dry-Type Transformers for General Applications
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2004) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA TP 1	(2002) Guide for Determining Energy Efficiency for Distribution Transformers
NEMA VE 1	(2009) Standard for Metal Cable Tray Systems
NEMA WD 1	(1999; R 2005; R 2010) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2002; R 2008) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2007; Errata 2007) American National Standard for Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

NFPA 70E	(2012) Standard for Electrical Safety in the Workplace
NFPA 780	(2011) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA J-STD-607	(2002a) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
TIA-568-C.1	(2009) Commercial Building Telecommunications Cabling Standard
TIA-569	(2004b; Add 1 2009) Commercial Building Standard for Telecommunications Pathways and Spaces

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Jul 2007) Standard for Flexible Metal Conduit
UL 1063	(2006) Machine-Tool Wires and Cables
UL 1242	(2006; Reprint Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1449	(2006; Reprint Feb 2011) Surge Protective Devices
UL 1561	(2011) Dry-Type General Purpose and Power Transformers
UL 1569	(1999; Reprint Jun 2009) Standard for Metal-Clad Cables
UL 198M	(2003; Reprint Oct 2007) Standard for Mine-Duty Fuses
UL 20	(2010) General-Use Snap Switches
UL 2043	(2008) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 360	(2009; Reprint Jun 2009) Liquid-Tight Flexible Steel Conduit

UL 4248	(2007) UL Standard for Safety Fuseholders
UL 44	(2010) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2003; Reprint Feb 2010) Wire Connectors
UL 486C	(2004; Reprint Feb 2010) Splicing Wire Connectors
UL 489	(2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2001; Reprint Apr 2010) Attachment Plugs and Receptacles
UL 5	(2004; Reprint Jul 2010) Surface Metal Raceways and Fittings
UL 50	(2007) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 508	(1999; Reprint Apr 2010) Industrial Control Equipment
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2004; Reprint Apr 2010) Metallic Outlet Boxes
UL 514B	(2004; Reprint Nov 2009) Conduit, Tubing and Cable Fittings
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 651	(2005; Reprint Mar 2010) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 67	(2009; Reprint Sep 2010) Standard for Panelboards
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 817	(2001; Reprint Oct 2009) Standard for Cord Sets and Power-Supply Cords

UL 83	(2008) Thermoplastic-Insulated Wires and Cables
UL 870	(2008) Standard for Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2006; Reprint May 2010) Ground-Fault Circuit-Interrupters
UL 96A	(2007) Standard for Installation Requirements for Lightning Protection Systems
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards

Transformers;

Cable trays;

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

Wireways;

SD-03 Product Data

Receptacles;

Circuit breakers;

Switches;

Transformers;

Enclosed circuit breakers;

Motor controllers Combination

motor controller;

Manual motor starters;

CATV outlets;

Telecommunications Grounding Busbar;

Surge protective devices;

Submittals shall include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test;

Grounding system test;

Transformer tests;

Ground-fault receptacle test;

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2,UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40(40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Steel compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.3 SURFACE RACEWAY

2.3.1 Surface Metal Raceway

UL 5, two-piece painted steel, totally enclosed, snap-cover type. Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Receptacles shall be as specified herein and shall be spaced minimum of one every 18 inches.

2.4 CABLE TRAYS

NEMA VE 1. Cable trays shall form a wireway system, and shall be of nominal 3 inch depth. Cable trays shall be constructed of aluminum, copper-free aluminum or steel that has been zinc-coated after fabrication. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius.

2.4.1 Basket-Type Cable Trays

Provide size as indicated with maximum wire mesh spacing of 2 by 4 inch.

2.4.2 Cantilever

Cantilever-type, center-hung cable trays may be provided at the Contractor's option in lieu of other cable tray types specified.

2.5 OPEN TELECOMMUNICATIONS CABLE SUPPORT

2.5.1 Open Top Cable Supports

Provide open top cable supports in accordance with UL 2043. Open top cable supports shall be galvanized or zinc-coated steel.

2.5.2 Closed Ring Cable Supports

Provide closed ring cable supports in accordance with UL 2043. Closed ring cable supports shall be steel.

2.6 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.6.1 Outlet Boxes for Telecommunications System

Provide standard type 4 11/16 inches square by 2 1/4 inches deep. Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend radii.

2.7 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.8 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.8.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and capacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.8.1.1 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.8.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

2.8.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.8.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.8.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with TIA J-STD-607. The TBB shall be a minimum No. 6 AWG and be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG. 2.8.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the telecommunications main grounding busbar (TMGB) and the electrical service ground in accordance with TIA J-STD-607. The bonding conductor for telecommunications shall be sized the same as the TBB.

2.8.5 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.8.6 Cable Tray Cable or Power Limited Tray Cable

UL listed; type TC or PLTC.

2.8.7 Cord Sets and Power-Supply Cords

UL 817.

2.9 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.10 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Plates on finished walls shall be nylon or lexan, minimum 0.03 inch wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.11 SWITCHES

2.11.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Handles shall be ivory thermoplastic. Wiring terminals shall be screw-type, side-wired or of the solderless pressure type having suitable conductor-release arrangement. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.11.2 Switch with Red Pilot Handle

NEMA WD 1. Provide pilot lights that are integrally constructed as a part of the switch's handle. The pilot light shall be red and shall illuminate whenever the switch is closed or "on". The pilot lighted switch shall be rated 20 amps and 120 volts or 277 volts as indicated. Provide the circuit's neutral conductor to each switch with a pilot light.

2.11.3 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

2.11.4 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 1, enclosure or as indicated, per NEMA ICS 6.

2.12 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch . Time-current characteristics curves of fuses serving motors or connected in

series with circuit breakers shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

2.12.1 Fuseholders

Provide in accordance with UL 4248.

2.12.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 198M, Class RK-1 or RK-5. Associated fuseholders shall be Class R only.

2.12.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 198M, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.12.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 198M, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.13 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory as per NEMA WD 1. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double or triple-wipe ground contacts.

2.13.1 Switched Duplex Receptacles

Provide separate terminals for each ungrounded pole. Top receptacle shall be switched when installed.

2.13.2 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

2.13.3 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFCI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.13.4 Special Purpose Receptacles

Provide in NEMA configuration indicated. Furnish one matching plug with each receptacle.

2.13.5 Plugs

Provide heavy-duty, rubber-covered three-wire cord of required size, install plugs thereon, and attach to equipment. Plugs shall be UL listed with receptacles, complete with grounding blades. Where equipment is not available, turn over plugs and cord assemblies to the Government.

2.14 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards shall be circuit breaker-equipped unless indicated otherwise. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" or "below" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Provide new directories for existing panels modified by this project as indicated. Type directories and mount in holder behind transparent protective covering. Panelboard shall have nameplates in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.14.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gauge if flush-mounted or mounted outdoors, and not less than No. 12 gauge if surface-mounted indoors, with full seam-welded box ends. Cabinets shall be painted in accordance with paragraph PAINTING. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch. Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets.

2.14.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.14.2.1 Panelboard Neutrals for Non-Linear Loads

UL listed, and panelboard type shall have been specifically UL heat rise tested for use on non-linear loads. Panelboard shall be heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing. Verification of the testing procedure shall be provided upon request. Two neutral assemblies paralleled together with cable is not acceptable. Nameplates for panelboard rated for use on non-linear loads shall be marked "SUITABLE FOR NON-LINEAR LOADS"and shall be in accordance with paragraph FIELD FABRICATED NAMEPLATES. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.14.3 Circuit Breakers

Shall be as specified in Section 26 28 01.00 COORDINATED POWER SYSTEM PROTECTION.

2.15 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

2.16 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs); shall conform to UL 508 and UL 489 and shall be provided as shown. MSCPs shall consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. MSCPs shall be rated in accordance with the requirements of NFPA 70.

2.17 TRANSFORMERS

NEMA ST 20, general purpose, dry-type, self-cooled, ventilated. Provide transformers in NEMA 1 enclosure. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 115 degrees C temperature rise shall be capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.17.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, shall be energy efficient type. Minimum efficiency, based on factory test results, shall not be less than NEMA Class 1 efficiency as defined by NEMA TP 1.

2.17.2 Transformers With Non-Linear Loads

Transformer insulation shall be a UL recognized 220 degrees C system. Neither the primary nor the secondary temperature shall exceed 220 degrees C at any point in the coils while carrying their full rating of non-sinusoidal load. Transformers are to be UL listed and labeled for K-9 in accordance with UL 1561. Transformers evaluated by the UL K-Factor evaluation shall be listed for 115 degrees C average temperature rise only. Transformers with K-Factor ratings with temperature rise of 150 degrees C rise shall not be acceptable. K-Factor rated transformers shall have an impedance range of 3 percent to 5 percent, and shall have a minimum reactance of 2 percent to prevent excessive neutral current when supplying loads with large amounts of third harmonic.

2.18 MOTORS

NEMA MG 1; hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Unless otherwise indicated, motors rated 1 HP and above shall be continuous duty type.

Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.18.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.18.2 Premium Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10. In addition, continuous rated, polyphase squirrel-cage medium induction motors shall meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.18.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-

loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.18.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment as specified herein. Power wiring and conduit shall conform to the requirements specified herein. Control wiring shall be provided under, and conform to the requirements of the section specifying the associated equipment.

2.19 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position. Minimum short circuit withstand rating of combination motor controller shall match electrical equipment feeding controller.

2.19.1 Control Wiring

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual

conductors of each external cable to be terminated on adjacent terminal points.

2.19.2 Control Circuit Terminal Blocks

NEMA ICS 4.Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.19.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.19.3 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder. One secondary lead shall be fused; other shall be grounded.

2.19.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.19.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers shall have compelling relays and shall be multiple-button, station-type with pilot lights for each speed.

2.19.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

2.19.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.19.8 Reduced-Voltage Controllers

Provide for polyphase motors where indicated. Reduced-voltage starters shall be single-step, closed transition autotransformer or solid state-type, or as indicated, and shall have adjustable time interval between application of reduced and full voltages to motors.

2.20 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Designed for surface mounting with overload protection and pilot lights.

2.20.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color shall be in accordance with NEMA ICS 2. Jewels for use with switches controlling motors shall be green; jewels for other purposes shall be white.

2.21 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 23, "Mechanical."

2.22 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires, cable trays, and other accessories for telecommunications outlets and pathway in accordance with TIA-569 and as specified herein. Additional telecommunications requirements are specified in Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.23 COMMUNITY ANTENNA TELEVISION (CATV) SYSTEM

CATV Outlets

Provide flush mounted, 75-ohm, F-type connector outlet rated from 5 to 1000 MHz in standard electrical outlet boxes with mounting frame.

2.23.2 CATV Faceplates

Provide modular faceplates for mounting of CATV Outlets. Faceplate color shall match outlet and switch coverplates.

2.23.3 Backboards

Provide void-free, fire rated interior grade plywood, 3/4 inch thick, 4 by 8 feet. Do not cover the fire stamp on the backboard.

2.24 GROUNDING AND BONDING EQUIPMENT

2.24.1 Ground Rods

UL 467. Ground rods shall be sectional type, copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.24.2 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated.

2.24.3 Telecommunications and CATV Grounding Busbar

Provide corrosion-resistant grounding busbar suitable for indoor installation in accordance with TIA J-STD-607. Busbars shall be plated for reduced contact resistance. If not plated, the busbar shall be cleaned prior to fastening the conductors to the busbar, and an anti-oxidant shall be applied to the contact area to control corrosion and reduce contact resistance. Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility and a (TGB) in all other telecommunications rooms and equipment rooms. The telecommunications main grounding busbar (TMGB) and the telecommunications grounding busbar (TGB) shall be sized in accordance with the immediate application requirements and with consideration of future growth. Provide telecommunications grounding busbars with the following:

a. Predrilled copper busbar provided with holes for use with standard sized lugs;

b. Minimum dimensions of 0.25 in thick by and <MET>50 mm</MET>2 in wide for TGBs with minimum length;

c. Listed by a nationally recognized testing laboratory.

2.25 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.26 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when

applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.27 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.28 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00, FIRESTOPPING.

2.29 WIREWAYS

UL 870. Material shall be steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with hinged-cover NEMA 1 enclosure per NEMA ICS 6.

2.30 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices which comply with UL 1449 at the service entrance, switchboard, and at panelboards where noted. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
Each phase to neutral (L-N)
Neutral to ground (N-G)
Phase to ground (L-G)

Surge protective devices shall have a minimum surge current rating of 80,000 amperes per mode minimum and 160,000 amperes per phase minimum.

The minimum MCOV (Maximum Continuous Operating Voltage) rating shall be:

300/150V for 120/240V, single phase system
300/150V for 208Y/120V, three phase system
600/320V for 480Y/277V, three phase system

EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

The UL 1449 3rd Edition Voltage Protection Ratings "VPR" (6kV, 3000 Amps, 8/20 microseconds waveform) shall not exceed the system voltage ratings as follows:

208/120V and 240/120V
Line to Neutral, 900V
Line to Ground, 900V
Neutral to Ground, 900V
Line to Line, 1200V

480/277V System
Line to Neutral, 1200V
Line to Ground, 1200V
Neutral to Ground, 1200V
Line to Line, 2000V

The SPD shall have a minimum UL 1449 3rd Edition Nominal Discharge Current Rating (In) of 10,000 Amps.

Surge protective devices shall be compatible with a lightning protection system and meet the requirements of UL 96A.

2.31 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray, and equipment located outdoors shall be ANSI Light Gray or Dark Gray. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or

specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be firestopped in accordance with Section 07 84 00, FIRESTOPPING.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.3.2 Metal Clad Cable

Install in accordance with NFPA 70, Type MC cable.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits in crawl space under floor as if exposed.

3.1.4.1 Restrictions Applicable to EMT

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.

d. Do not use in hazardous areas.

e. Do not use outdoors.

f. Do not use in fire pump rooms.

g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40 and PVC Schedule 80

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms,

electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in fire pump rooms.

(4) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

(5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

(6) Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.3 Restrictions Applicable to MC Cabling

MC Cable may only be used where approved in advance by the Contract Officer and the Project Engineer.

3.1.4.4 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.5 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 18 inches below slab or grade.

3.1.4.6 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40. Convert nonmetallic conduit to plastic-coated rigid, or IMC steel conduit before rising through floor slab. Plastic coating shall extend minimum 6 inches above floor.

3.1.4.7 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.4.8 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

3.1.4.9 Conduit Installed in Concrete Floor Slabs

Rigid steel; steel IMC; or PVC, Type EPC-40. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Increase slab

thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings shall allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab. Where nonmetallic conduit is used, raceway shall be converted to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

3.1.4.10 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.11 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.12 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.13 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.14 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.4.15 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with TIA-569.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room shall be installed and cabling length requirements in accordance with TIA-568-C.1. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling) shall be installed in accordance with TIA-569. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated. 3.1.4.16 Community Antenna Television (CATV) System Conduits

Install a system of CATV wire-supporting structures (pathway), including: outlet boxes, conduits wireways, cable trays, and other accessories for CATV outlets and pathway in accordance with TIA-569. Distribution system shall be star topology from each outlet box to the telecommunications room.

3.1.5 Cable Tray Installation

Install and ground in accordance with NFPA 70. In addition, install and ground telecommunications cable tray in accordance with TIA-569, and TIA J-STD-607. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Support in accordance with manufacturer recommendations but at not more than 10 foot intervals. Contact surfaces of aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. For grounding of cable tray system provide No. 2 AWG bare copper wire throughout cable tray system, and bond to each section, except use No. 1/0 aluminum wire if cable tray is aluminum. Terminate cable trays 10 inches from both sides of smoke and fire partitions. Conductors run through smoke and fire partitions shall be installed in 4 inch rigid steel conduits with grounding bushings, extending 12 inches beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. Penetrations shall be firestopped in accordance with Section 07 84 00, FIRESTOPPING.

Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.6 Telecommunications Cable Support Installation

Install open top and closed ring cable supports on 4 ft to 5 ft centers to adequately support and distribute the cable's weight. These types of supports shall be used to support a maximum of 50 0.25 in diameter cables. Install suspended cables with at least 3 in of clear vertical space above the ceiling tiles and support channels (T-bars). Open top and closed ring cable supports shall be suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.

3.1.7 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, and when specifically indicated. Boxes in other locations shall be sheet steel, except that nonmetallic boxes may be used with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces.Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.7.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets shall be a minimum of 4 11/16 inches square by 2 1/4 inches deep. Mount outlet boxes flush in finished walls.

3.1.7.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, and compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.7.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.

3.1.8 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches and handicapped telecommunications stations 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet.

3.1.9 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.9.1 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.10 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.11 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.12 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.13 Grounding and Bonding

Provide In accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This shall include lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Interconnection to the gas line shall be made on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA J-STD-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.13.1 Ground Rods

Provide cone pointed ground rods. The resistance to ground shall be measured using the fall-of-potential method described in IEEE 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 10 feet on centers, shall be driven with the first rod. Until the resultant resistance does not exceed 25 ohms measured not less than 48 hours after rainfall.

3.1.13.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.13.3 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated. Transformer neutrals and electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to the entrance ground. Connections and splices shall be of the bolted type.

3.1.13.4 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.13.5 Telecommunications System

Provide telecommunications grounding in accordance with the following:

a. Telecommunications Grounding Busbars: Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility.Provide a telecommunications grounding busbar (TGB) in all other telecommunications rooms and telecommunications equipment rooms. The TGB shall be as close to the telecommunications room panelboard as practicable, when equipped. Where a panelboard for telecommunications equipment is not installed in the telecommunications room, the TGB shall be located near the backbone cabling and associated terminations. In addition, the TGB shall be placed to provide for the shortest and straightest routing of the grounding conductors. Where a panelboard for telecommunications equipment is located within the same room or space as a TGB, that panelboard’s alternating current equipment ground (ACEG) bus (when equipped) or the panelboard enclosure shall be bonded to the TGB. Telecommunications grounding busbars shall be installed to maintain clearances as required by NFPA 70 and shall be insulated from its support. A minimum of 2 inches separation from the wall is recommended to allow access to the rear of the busbar and the mounting height shall be adjusted to accommodate overhead or underfloor cable routing.

b. Telecommunications Bonding Conductors: Provide main telecommunications service equipment ground consisting of separate bonding conductor for telecommunications, between the TMGB and readily accessible grounding connection of the electrical service. Grounding and bonding conductors

should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum. Provide a telecommunications bonding backbone (TBB) that originates at the TMGB extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. The TBB conductors shall be installed and protected from physical and mechanical damage. The TBB conductors should be installed without splices and routed in the shortest possible straight-line path. The bonding conductor between a TBB and a TGB shall be continuous. Where splices are necessary, the number of splices should be a minimum and they shall be accessible and located in telecommunications spaces. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors, or equivalent. All joints shall be adequately supported and protected from damage. The TBB and GE shall not be connected to the pathway ground, except at the TMGB or the TGB.

c. Telecommunications Grounding Connections: Telecommunications grounding connections to the TMGB or TGB shall utilize listed compression two-hole lugs, exothermic welding, suitable and equivalent one hole non-twisting lugs, or other irreversible compression type connections. All metallic pathways, cabinets, and racks for telecommunications cabling and interconnecting hardware located within the same room or space as the TMGB or TGB shall be bonded to the TMGB or TGB respectively. In a metal frame (structural steel) building, where the steel framework is readily accessible within the room; each TMGB and TGB shall be bonded to the vertical steel metal frame using a minimum No. 6 AWG conductor. Where the metal frame is external to the room and readily accessible, the metal frame shall be bonded to the TGB or TMGB with a minimum No. 6 AWG conductor. When practicable because of shorter distances and, where horizontal steel members are permanently electrically bonded to vertical column members, the TGB may be bonded to these horizontal members in lieu of the vertical column members. All connectors used for bonding to the metal frame of a building shall be listed for the intended purpose.

3.1.14 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.1.15 Not used

3.1.16 Government-Furnished Equipment

Contractor shall rough-in for Government-furnished equipment and shall make connections to Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

3.1.17 Demolition of Existing Work

Demolition of existing electrical distribution systems shall be performed as follows:

3.1.17.1 Existing Concealed Wiring to be Removed

Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.17.2 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment shall include equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, as indicated.

3.1.18 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 26 23 00

SWITCHBOARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM D1535	(2008e1) Specifying Color by the Munsell System
ASTM D709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012) National Electrical Safety Code
IEEE C37.90.1	(2002; Errata 2003; Errata 2004) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C57.12.28	(2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity

IEEE C57.13	(2008) Standard Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.1	(2008) Electric Meters Code for Electricity Metering
ANSI/NEMA PB 2.1	(2007) General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA LI 1	(1998) Industrial Laminating Thermosetting Products
NEMA PB 2	(2006) Deadfront Distribution Switchboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 489	(2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 891	(2005) Switchboards

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchboard Drawings;

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control

panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

SD-03 Product Data

Switchboard;

SD-06 Test Reports

Acceptance checks and tests;

SD-10 Operation and Maintenance Data

Switchboard Operation and Maintenance, Data Package 5;

SD-11 Closeout Submittals

Assembled Operation and Maintenance Manuals;

Equipment Test Schedule;

Request for Settings;

1.4 QUALITY ASSURANCE

1.4.1 Switchboard Product Data

Each submittal shall include manufacturer's information for each component, device and accessory provided with the switchboard including:

a. Circuit breaker type, interrupting rating, and trip devices, including available settings

b. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device.

1.4.2 Switchboard Drawings

Drawings shall include, but are not limited to the following:

a. One-line diagram including breakers, fuses, current transformers, and meters

b. Outline drawings including front elevation, section views, footprint, and overall dimensions

c. Bus configuration including dimensions and ampere ratings of bus bars

d. Markings and NEMA nameplate data, including fuse information (manufacturer's name, catalog number, and ratings)

e. Circuit breaker type, interrupting rating, and trip devices, including available settings

f. Three-line diagrams and elementary diagrams and wiring diagrams with terminals identified, and indicating prewired interconnections between items of equipment and the interconnection between the items.

g. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device. These shall be used by the designer of record to provide breaker settings that will ensure protection and coordination are achieved.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 MAINTENANCE

1.5.1 Switchboard Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with DIVISION 01 GENERAL REQUIREMENTS.

1.5.2 Assembled Operation and Maintenance Manuals

Manuals shall be assembled and bound securely in durable, hard covered, water resistant binders. The manuals shall be assembled and indexed in the following order with a table of contents. The contents of the assembled operation and maintenance manuals shall be as follows:

a. Manufacturer's O&M information required by the paragraph entitled "SD-10, Operation and Maintenance Data".

b. Catalog data required by the paragraph entitled, "SD-03, Product Data".

c. Drawings required by the paragraph entitled, "SD-02, Shop Drawings".

d. Spare parts and supply list.

e. Information on metering

f. Design test reports

g. Production test reports

1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be switchboards or related accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.2 SWITCHBOARD

NEMA PB 2 and UL 891.

2.2.1 Ratings

The voltage rating of the switchboard shall be 480Y/277 volts AC, 4-wire 3 phase. The continuous current rating of the main bus shall be as indicated. The short-circuit current rating shall be as indicated. The switchboard shall be UL listed and labeled as service entrance equipment.

2.2.2 Construction

Switchboard shall consist of vertical sections bolted together to form a rigid assembly and shall be front aligned. All circuit breakers shall be front accessible. Where indicated, "space for future" or "space" shall mean to include bus, device supports, and connections. Provide insulating barriers in accordance with NEMA LI 1, Type GPO-3, 0.25 inch minimum

thickness. Apply moisture resistant coating to all rough-cut edges of barriers. Switchboard shall be completely factory engineered and assembled, including protective devices and equipment indicated with necessary interconnections, instrumentation, and control wiring.

2.2.2.1 Enclosure

The switchboard enclosure shall be a NEMA ICS 6 Type 1. Enclosure shall be bolted together with removable bolt-on side and rear covers. Bases, frames and channels of enclosure shall be corrosion resistant and shall be fabricated of or galvanized steel. Base shall include any part of enclosure that is within 3 inches of concrete pad. Galvanized steel shall be ASTM A123/A123M, ASTM A653/A653M G90 coating, and ASTM A153/A153M, as applicable. Galvanize after fabrication where practicable. Paint enclosure, including bases, ASTM D1535 light gray No. 61 or No. 49. Paint coating system shall comply with IEEE C57.12.28 for galvanized steel.

2.2.2.2 Bus Bars

Bus bars shall be copper with silver-plated contact surfaces or aluminum with tin-plated contact surfaces. Plating shall be a minimum of 0.0002 inch thick. Make bus connections and joints with hardened steel bolts. The through-bus shall be rated at the full ampacity of the main throughout the switchboard. Provide minimum one-quarter by 2 inch copper ground bus secured to each vertical section along the entire length of the switchboard. The neutral bus shall be rated 100 percent of the main bus continuous current rating.

2.2.2.3 Main Section

The main section shall consist of an individually mounted molded-case, electronic circuit breaker.

2.2.2.4 Distribution Sections

The distribution section shall consist of molded-case circuit breakers as indicated.

2.2.2.5 Handles

Handles for individually mounted devices shall be of the same design and method of external operation. Label handles prominently to indicate device ampere rating, color coded for device type. Identify ON-OFF indication by handle position and by prominent marking.

2.2.3 Protective Device

Provide main and branch protective devices as indicated.

2.2.3.1 Molded-Case Circuit Breaker

UL 489. UL listed and labeled, 100 percent rated, stationary, manually operated, low voltage molded-case circuit breaker, with a short-circuit current rating of as indicated. Breaker frame size shall be as indicated. Series rated circuit breakers are unacceptable.

2.2.4 Electronic Trip Units

Equip main and distribution breakers as indicated with a solid-state tripping system consisting of three current sensors and a microprocessor-based trip unit that will provide true rms sensing adjustable time-current circuit protection. The ampere rating of the current sensors shall be as indicated. The trip unit ampere rating shall be as indicated. Ground fault protection shall be zero sequence sensing. The electronic trip units shall have the features as indicated.

2.2.5 Watthour and Digital Meters

2.2.5.1 Digital Meters

IEEE C37.90.1 for surge withstand. Provide true rms, plus/minus one percent accuracy, programmable, microprocessor-based meter enclosed in sealed cases with a simultaneous three line, twelve value LED display. Meters shall have 0.56 inch, minimum, LEDs. The meters shall accept input from standard 5A secondary instrument transformers and direct voltage monitoring range to 600 volts, phase to phase. Programming shall be via a front panel display and a communication interface with a computer. Password secured programming shall be stored in non-volatile EEPROM memory. Digital communications shall be Modbus RTU protocol via a RS485 serial port. The meter shall calculate and store average max/min demand values for all readings based on a user selectable sliding window averaging period. The meter shall have programmable hi/low set limits with two Form C dry contact relays when exceeding alarm conditions. Meter shall provide Total Harmonic Distortion (THD) measurement to the thirty-first order. Historical trend logging capability shall include ability to store up to 100,000 data points with intervals of 1 second to 180 minutes. The unit shall also store and time stamp up to 100 programmable triggered conditions. Event waveform recording shall be triggered by the rms of 2 cycles of voltage or current exceeding programmable set points.Waveforms shall be stored for all 6 channels of voltage and current for a minimum of 10 cycles prior to the event and 50 cycles past the event.

a. Multi-Function Meter: Meter shall simultaneously display a selected phase to neutral voltage, phase to phase voltage, percent phase to neutral voltage THD, percent phase to phase voltage THD; a selected phase current, neutral current, percent phase current THD, percent neutral current; selected total PF, kW, KVA, kVAR, FREQ, kVAh, kWh. Detected alarm conditions include over/under current, over/under voltage, over/under KVA, over/under frequency, over/under selected PF/kVAR, voltage phase reversal, voltage imbalance, reverse power, over percent THD. The meter shall have a Form C KYZ pulse output relay.

2.2.6 Current Transformers

CT Ratio	RF	Accuracy Class
200/5	4.0	0.3 thru B-0.1
300/5	3.0	0.3 thru B-0.2
400/5	4.0	0.3 thru B-0.2

600/5	4.0	0.3 thru B-0.5
800/5	2.0	0.3 thru B-0.5
1200/5	1.5	0.3 thru B-0.5
1500/5	1.5	0.3 thru B-0.9
2000/5	1.5	0.3 thru B-1.8

IEEE C57.13. Transformers shall be single ratio, 60 hertz, 2000 to 5-ampere ratio, 1.5 rating factor, with a metering accuracy class of 0.3 through B-1.8.

2.2.7 Meter Fusing

Provide a fuse block mounted in the metering compartment containing one fuse per phase to protect the voltage input to voltage sensing meters. Size fuses as recommended by the meter manufacturer.

2.2.8 Terminal Boards

Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Terminal boards associated with current transformers shall be short-circuiting type. Terminate conductors for current transformers with ring-tongue lugs. Terminal board identification shall be identical in similar units. External wiring shall be color coded consistently for similar terminal boards.

2.2.9 Wire Marking

Mark control and metering conductors at each end. Provide factory-installed, white, plastic tubing, heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide white, preprinted, polyvinyl chloride (PVC) sleeves, heat stamped with black block type letters. Each sleeve shall contain a single letter or number, shall be elliptically shaped to securely grip the wire, and shall be keyed in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Each wire marker shall indicate the device or equipment, including specific terminal number to which the remote end of the wire is attached.

2.2.10 Surge Protective Device

Provide as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

2.4 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each switchboard, equipment enclosure, relay, switch, and device; as specified in this section or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.5 SOURCE QUALITY CONTROL

2.5.1 Equipment Test Schedule

The Government reserves the right to witness tests. Provide equipment test schedules for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.

3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.

4. Dated calibration labels shall be visible on all test equipment.

5. Calibrating standard shall be of higher accuracy than that of the instrument tested.

6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.5.2 Switchboard Design Tests

NEMA PB 2 and UL 891.

2.5.2.1 Design Tests

Furnish documentation showing the results of design tests on a product of the same series and rating as that provided by this specification.

a. Short-circuit current test

b. Enclosure tests

c. Dielectric test

2.5.3 Switchboard Production Tests

NEMA PB 2 and UL 891. Furnish reports which include results of production tests performed on the actual equipment for this project. These tests include:

a. 60-hertz dielectric tests

b. Mechanical operation tests

c. Electrical operation and control wiring tests

d. Ground fault sensing equipment test

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Equipment Grounding

Provide bare copper cable not smaller than No. 4/0 AWG not less than 24 inches below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 Switchboard

ANSI/NEMA PB 2.1.

3.3.2 Meters and Instrument Transformers

ANSI C12.1.

3.3.3 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3.4 Galvanizing Repair

Repair damage to galvanized coatings using ASTM A780/A780M, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

3.3.5 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

3.4.1 Interior Location

Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 4 inches thick. The top of the concrete slab shall be approximately 4 inches above finished floor. Edges above floor shall have 1/2 inch chamfer. The slab shall be of adequate size to project at least 8 inches beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 inches above slab surface.

3.5 FIELD QUALITY CONTROL

Contractor shall submit request for settings of breakers to the COR after approval of switchboard and at least 30 days in advance of their requirement.

3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.5.1.1 Switchboard Assemblies

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical, electrical, and mechanical condition.

3. Confirm correct application of manufacturer's recommended lubricants.

4. Verify appropriate anchorage, required area clearances, and correct alignment.

5. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

6. Verify that circuit breaker sizes and types correspond to approved shop drawings.

7. Verify that current transformer ratios correspond to approved shop drawings.

8. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

9. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

10. Clean switchboard.

11. Inspect insulators for evidence of physical damage or contaminated surfaces.

12. Exercise all active components.

13. Inspect all mechanical indicating devices for correct operation.

14. Verify that vents are clear.

15. Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

16. Inspect control power transformers.

b. Electrical Tests

1. Perform insulation-resistance tests on each bus section.

2. Perform overpotential tests.

3. Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.

4. Perform control wiring performance test.

5. Perform primary current injection tests on the entire current circuit in each section of assembly.

3.5.1.2 Circuit Breakers

Low Voltage Molded Case with Solid State Trips

a. Visual and Mechanical Inspection

1. Compare nameplate data with specifications and approved shop drawings.

2. Inspect circuit breaker for correct mounting.

3. Operate circuit breaker to ensure smooth operation.

4. Inspect case for cracks or other defects.

5. Inspect all bolted electrical connections for high resistance using low resistance ohmmeter, verifying tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method, or performing thermographic survey.

6. Inspect mechanism contacts and arc chutes in unsealed units.

b. Electrical Tests

1. Perform contact-resistance tests.

2. Perform insulation-resistance tests.

3. Perform Breaker adjustments for final settings in accordance with Government provided settings.

4. Perform long-time delay time-current characteristic tests

5. Determine short-time pickup and delay by primary current injection.

6. Determine ground-fault pickup and time delay by primary current injection.

7. Determine instantaneous pickup current by primary injection.

8. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and anti-pump function.

3.5.1.3 Current Transformers

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify correct connection.

4. Verify that adequate clearances exist between primary and secondary circuit.

5. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

6. Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

2. Perform insulation-resistance tests.

3. Perform polarity tests.

4. Perform ratio-verification tests.

3.5.1.4 Metering and Instrumentation

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify tightness of electrical connections.

b. Electrical Tests

1. Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

2. Calibrate watthour meters according to manufacturer's published data.

3. Verify all instrument multipliers.

4. Electrically confirm that current transformer and voltage transformer secondary circuits are intact.

3.5.1.5 Grounding System

a. Visual and Mechanical Inspection

1. Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

1. IEEE 81. Perform ground-impedance measurements utilizing the fall-of-potential method.On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.5.2 Follow-Up Verification

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device. Test shall require each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times for checks, settings, and tests.

-- End of Section --

SECTION 26 41 01.00 10

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C135.30	(1988) Standard for Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code
NFPA 780	(2011) Standard for the Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 96	(2005; Reprint Oct 2010) Standard for Lightning Protection Components
UL 96A	(2007; Reprint Oct 2010) Standard for Installation Requirements for Lightning Protection Systems
UL Electrical Construction	(2009) Electrical Construction Equipment Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-07 Certificates

Materials

1.3 QUALITY ASSURANCE

Submit detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide a system consisting of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and which is the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

2.2 MATERIALS

Submit proof of compliance with requirements of UL, where material or equipment is specified to comply. The label of or listing in UL Electrical Construction will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted.

2.2.1 General Requirements

Do not use any combination of materials that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture, unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist, which would cause corrosion of conductors, use conductors with protective coatings or oversize conductors. Where a mechanical hazard is involved, increase the conductor size to compensate for the hazard or protect the conductors by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.2.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.2.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 375 pounds/thousand feet, and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.2.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal.

Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. When perforated strips are provided, strips that are much wider than solid strips shall be. A strip width that is at least twice that of the diameter of the perforations shall be used. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 1-1/2 inch wide.

2.2.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of 2 feet above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 5 feet above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of 15 feet above vent opening. Air terminals more than 24 inch in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

2.2.4 Ground Rods

Rods made of copper-clad steel, stainless steel or solid copper shall conform to UL 467 and galvanized ferrous rods shall conform to IEEE C135.30. Ground rods shall be not less than 3/4 inch in diameter and 10 feet in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.2.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation.

2.2.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INTEGRAL SYSTEM

3.2.1 General Requirements

Provide a lightning protection system consisting of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on

the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.2.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inch for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 24 inch away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 24 inches away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

3.2.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inch. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 3 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.2.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 110 feet long, there shall be at least one additional down conductor for each additional 50 feet of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 250 feet in perimeter, there shall be at least one additional down conductor for each 100 feet of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. On structures exceeding 50 feet in height, there shall be at least one additional down conductor for each additional 60 feet of height or fraction thereof, except that this application shall not cause down conductors to be placed about the perimeter of the structure at intervals of less than 50 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 16 feet in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected by placing in pvc conduit.

3.2.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.2.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.2.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 3 feet, nor more than 8 feet, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value, the Contracting Officer shall be notified immediately. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 3 feet nor more than 8 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous.

3.2.2 Metal Roofs

Wood-Frame, Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 100 feet. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof. Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 3 square inch.

3.2.3 Metal Roofs With Metal Walls

Wood-Frame Building With Metal Roof and Metal Exterior Walls: The metal roof and the metal walls shall be bonded and made electrically continuous and considered as one unit. The air terminals shall be connected to and made electrically continuous with the metal roof as well as the roof and down conductors. All connections shall have electrical continuity and have a surface contact of at least 3 square inch.

3.2.4 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge.Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point of entrance by a ground connector. Connections to pipes shall be by means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding.All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground

connections to grounding electrons or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than 60 feet.

3.3 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. Metal bodies of conductance having an area of 400 square inch or greater or a volume of 1000 cubic inch or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inch. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

3.4 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI ANSLG C78.81	(2010) American National Standard for Electric Lamps--Double-Capped Fluorescent Lamps--Dimensional and Electrical Characteristics

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2007) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

CALIFORNIA ENERGY COMMISSION (CEC)

CEC Title 24	(1978; R 2005) California's Energy Efficiency Standards for Residential and Nonresidential Buildings

GREEN SEAL (GS)

GC-12	(1997) Occupancy Sensors

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000; Errata 2004; Errata 2005; Errata 2006) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012) National Electrical Safety Code
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C78.901	(2005) American National Standard for Electric Lamps - Single Base Fluorescent Lamps--Dimensional and Electrical Characteristics
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C82.11	(2011) American National Standard for High-Frequency Fluorescent Lamp Ballasts--Supplements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA LL 1	(1997; R 2002) Procedures for Linear Fluorescent Lamp Sample Preparation and the TCLP Extraction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2012) Life Safety Code
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1598	(2008; Reprint Jan 2010) Luminaires
UL 773	(1995; Reprint Mar 2002) Standard for Plug-In, Locking Type Photocontrols for Use with Area Lighting

UL 773A	(2006; Reprint Mar 2011) Standard for Nonindustrial Photoelectric Switches for Lighting Control
UL 924	(2006; Reprint Feb 2011) Standard for Emergency Lighting and Power Equipment
UL 935	(2001; Reprint Jun 2010) Standard for Fluorescent-Lamp Ballasts

1.2 RELATED REQUIREMENTS

Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

c. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SYSTEM DESCRIPTION

1.4.1 Lighting Control System

Provide lighting control system as indicated. Lighting control equipment shall include, if indicated: control modules, power packs, dimming ballasts, occupancy sensors, and light level sensors.

1.5 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IESNA HB-9, as applicable, for the lighting system specified.

SD-03 Product Data

Fluorescent lighting fixtures;

Fluorescent electronic ballasts;

Fluorescent lamps;

LED Fixtures;

Incandescent lighting fixtures;

Incandescent lamps;

Lighting contactor;

Photocell switch;

Exit signs;

Emergency lighting equipment;

Occupancy sensors;

SD-06 Test Reports

Operating test

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5

Submit operation and maintenance data in accordance with DIVISION 01 GENERAL REQUIREMENTS and as specified herein, showing all light fixtures, control modules, control zones, occupancy sensors, power packs, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

1.6 QUALITY ASSURANCE

1.6.1 Fluorescent Electronic Ballasts

Submit ballast catalog data as required in the paragraph entitled "Fluorescent Lamp Electronic Ballasts" contained herein. As an option, submit the fluorescent fixture manufacturer's electronic ballast specification information in lieu of the actual ballast manufacturer's catalog data. This information shall include published specifications and sketches, which covers the information required by the paragraph entitled "Fluorescent Lamp Electronic Ballasts" herein. This information may be supplemented by catalog data if required, and shall contain a list of vendors with vendor part numbers.

1.6.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall

include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer

1.6.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.3.3 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 Electronic Ballast Warranty

Furnish the electronic ballast manufacturer's warranty. The warranty period shall not be less than 5 years from the date of manufacture of the electronic ballast. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed 12 months, thereby permitting 4 years of the ballast 5 year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

1.8 OPERATIONAL SERVICE

Indicate procedures for compliance with regulations governing disposal of mercury.

1.9 SUSTAINABLE DESIGN REQUIREMENTS

1.9.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES

UL 1598. Fluorescent fixtures shall have electronic ballasts.

2.1.1 Fluorescent Lamp Electronic Ballasts

The electronic ballast shall as a minimum meet the following characteristics:

a. Ballast shall comply with UL 935, NEMA ANSLG C82.11, NFPA 70, and CEC Title 24 unless specified otherwise. Ballast shall be 100 percent electronic high frequency type with no magnetic core and coil components. Ballast shall provide transient immunity as recommended by IEEE C62.41.1 and IEEE C62.41.2. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.

b. Ballast shall operate at a frequency of 20,000 Hertz (minimum). Ballast shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems. Provide ballasts operating at or above 40,000 Hertz where available.

c. Ballast shall have light regulation of plus or minus 10 percent lumen output with a plus or minus 10 percent input voltage regulation. Ballast shall have 10 percent flicker (maximum) using any compatible lamp.

d. Ballast factor shall be between 0.85 (minimum) and 1.00 (maximum). Current crest factor shall be 1.7 (maximum).

e. Ballast shall be UL listed Class P with a sound rating of "A."

f. Ballast shall have circuit diagrams and lamp connections displayed on the ballast.

g. Ballasts shall be instant start unless otherwise indicated. Instant start ballasts shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed.

h. Ballasts for compact fluorescent fixtures shall be programmed start.

i. Ballasts for T-5 and smaller lamps shall have end-of-life protection circuits as required by ANSI ANSLG C78.81 and ANSI C78.901 as applicable.

j. Ballast shall be capable of starting and maintaining operation at a minimum of 0 degrees F unless otherwise indicated.

k. Electronic ballast shall have a full replacement warranty of 5 years from date of manufacture as specified in paragraph entitled "Electronic Ballast Warranty" herein.

2.1.1.1 T-8 Lamp Ballast

a. Total harmonic distortion (THD): Shall be 20 percent (maximum).

b. Input wattage.

1. 28 watts (maximum) when operating one F28T8 lamp

2.1.2 Fluorescent Lamps

a. T-8 rapid start low mercury lamps shall be rated 28 watts (maximum), 2800 initial lumens (minimum), CRI of 80 (minimum), color temperature of 4100 K, and an average rated life of 20,000 hours. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.

b. Compact fluorescent lamps shall be: CRI 80, minimum, 4100K, 10,000 hours average rated life, and as follows:

1. T-4, triple twin tube, rated 18 watts, 1200 initial lumens (minimum), and 26 watts, 1800 initial lumens (minimum), 32 watts, 2400 initial lumens (minimum).

Average rated life is based on 3 hours operating per start.

2.1.3 Compact Fluorescent Fixtures

Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall use lamps as indicated, with a minimum CRI of 80.

2.1.4 Open-Tube Fluorescent Fixtures

Provide with self-locking sockets, or lamp retainers (two per lamp).

2.2 INCANDESCENT LIGHTING FIXTURES

UL 1598.

2.2.1 Incandescent Lamps

Provide the number, type, and wattage indicated.

2.3 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

2.4 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb

installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

2.5 SWITCHES

2.5.1 Toggle Switches

Provide toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.6 LIGHTING CONTACTOR

NEMA ICS 2, electrically held contactor. Rate contactor as indicated. Provide in NEMA 1 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts. Provide contactor with hand-off-automatic selector switch.

2.7 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 120 volts ac, 60 Hz with single-throw contacts. Switch shall turn on at or below 3 footcandles and off at 2 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide switch:

a. In a cast weatherproof aluminum housing with adjustable window slide, rated 1800 VA, minimum.

2.8 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type. Exit signs shall use no more than 5 watts.

2.8.1 Self-Powered LED Type Exit Signs (Battery Backup)

Provide with automatic power failure device, test switch, pilot light, integral self-testing module and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit sign shall have emergency run time of 1 1/2 hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).

2.9 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

2.9.1 Emergency Lighting Unit

Provide as indicated. Emergency lighting units shall be rated for 12 volts, except units having no remote-mounted lamps and having no more than two

unit-mounted lamps may be rated 6 volts. Equip units with brown-out sensitive circuit to activate battery when ac input falls to 75 percent of normal voltage. Provide integral self-testing module.

2.9.2 Fluorescent Emergency System

Each system shall consist of an automatic power failure device, test switch operable from outside of the fixture, pilot light visible from outside the fixture, and fully automatic solid-state charger in a self-contained power pack. Provide self-testing module integral to the fixture. Charger shall be either trickle, float, constant current or constant potential type, or a combination of these. Battery shall be sealed electrolyte type with capacity as required to supply power to 2 lamps for 90 minutes at the minimum lumens shown on fixture schedule. Battery shall operate unattended and require no maintenance, including no additional water, for a period of not less than 5 years. Emergency ballasts provided with fixtures containing solid-state ballasts shall be fully compatible with the solid-state ballasts.

2.10 SELF-TESTING MODULE

Self-testing module for exit signs and emergency lighting equipment shall perform the following functions:

a. Continuous monitoring of charger operation and battery voltage with visual indication of normal operation and of malfunction.

b. Monthly discharge cycling of battery with monitoring of transfer circuit function, battery capacity and emergency lamp operation with visual indication of malfunction. The battery capacity test may be conducted by using a synthetic load.

c. Manual test switch to simulate a discharge test cycle.

d. Module shall have low voltage battery disconnect (LVD) and brown-out protection circuit.

2.11 OCCUPANCY SENSORS

UL listed. Comply with GC-12. Occupancy sensors and power packs shall be designed to operate on the voltage indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator.Sensor shall have adjustable sensitivity and adjustable delayed-off time range of 5 minutes to 15 minutes. Wall mounted sensors shall match the color of adjacent wall plates as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated.

a. Ultrasonic sensor shall be crystal controlled and shall not cause detection interference between adjacent sensors.

b. Infrared sensors shall have a daylight filter. Sensor shall have a fresnel lens that is applicable to space to be controlled.

c. Ultrasonic/Infrared Combination Sensor

d. Microwave and audiophonic sensors.

Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection. Lights shall remain on if either the ultrasonic or infrared sensor detects movement. Infrared sensor shall have lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Ultrasonic sensor frequency shall be crystal controlled.

2.12 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

2.12.1 Wires

ASTM A641/A641M, galvanized regular coating, soft temper, 0.1055 inches in diameter (12 gage).

2.12.2 Straps

Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.12.3 Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.13 EQUIPMENT IDENTIFICATION

2.13.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.13.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. All luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only_____":

a. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

c. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

d. ANSI ballast type (M98, M57, etc.) for HID luminaires.

e. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

All markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.14 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer.

3.1.2 Lighting Fixtures

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four wires or straps or rods per fixture and located near each corner of each fixture. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires or straps or rods per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture. Provide wires or straps or rods for lighting fixture support in this section. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

3.1.3 Suspended Fixtures

Suspended fixtures shall be provided with 45 degree swivel hangers so that they hang plumb and shall be located with no obstructions within the 45

degree range in all directions. The stem, canopy and fixture shall be capable of 45 degree swing. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degree separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.4 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.

3.1.5 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations. Set adjustable window slide for 3 minimum footcandles photocell turn-on.

3.1.6 Occupancy Sensor

Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage shall provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid nuisance activation and deactivation due to sudden temperature or airflow changes and usage. Set sensor "on" duration to 10 minutes.

3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.

3.3.1 Occupancy Sensor

Test sensors for proper operation. Observe for light control over entire area being covered.

-- End of Section --

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS-4	(2006) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C136.21	(2004) Roadway Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 108	(2006) Standard Specification for Aluminum-Alloy Permanent Mold Castings

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000; Errata 2004; Errata 2005) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; Errata 2007) National Electrical Safety Code
IEEE Std 100	(2000) The Authoritave Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C136.13	(2004) Roadway Lighting Equipment, Metal Brackets for Wood Poles
NEMA C136.3	(2005) Roadway and Area Lighting Equipment Luminaire Attachments
NEMA C78.42	(2004) Standard for High-Pressure Sodium Lamps
NEMA C78.43	(2007) Standard for Electric Lamps - Single-Ended Metal-Halide Lamps
NEMA C82.4	(2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
NEMA ICS 2	(2000; Errata 2002; R 2005; Errata 2006) Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment
NEMA ICS 6	(1993; R 2006) Standard for Industrial Controls and Systems Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1029	(1994; Rev thru Feb 2006) Standard for Safety High-Intensity-Discharge Lamp Ballasts
UL 1598	(2004; Rev thru May 2006) Luminaires
UL 773	(1995; Rev thru Mar 2002) Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2006) Nonindustrial Photoelectric Switches for Lighting Control

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Energy Efficiency

Luminaires;

Lamps;

Ballasts;

Lighting contactor;

Time switch;

Photocell switch;

Aluminum poles;

SD-06 Test Reports

Operating test;

Submit operating test results.

SD-10 Operation and Maintenance Data

Operational Service

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project.

1.4 QUALITY ASSURANCE

1.4.1 Not used.

1.4.2 Not used.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer Technical Representative.

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Aluminum Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.6.2 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

1.7 WARRANTY

Comply with warranty provisions of Section 01 78 00, "CLOSEOUT SUBMITTALS." The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render

satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 OPERATIONAL SERVICE

Indicate procedures for compliance with regulations governing disposal of mercury.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in Section 26 51 00 INTERIOR LIGHTING.

2.2 LUMINAIRES

UL 1598. Provide luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.2.1 Lamps

2.2.1.1 High-Pressure Sodium (HPS) Lamps

NEMA C78.42. Wattage as indicated. HPS lamps shall have average rated life of 16,000 hours (minimum) for 35 watt lamps and 24,000 hours (minimum) for all higher wattage lamps. 150 watt lamps, if required, shall be 55 volt lamps. Lamps shall have Luminaire Efficiency Ratings (LER) as follows:

a. Upward efficiency of 0%

    1. 150-399 watts: minimum 58 LER for closed fixture; minimum 68 for open fixture

    2. 400-999 watts: minimum 63 LER for closed fixture; minimum 84 for open fixture

b. Upward efficiency of 1%-10%

    1. 150-399 watts: minimum 64 LER for closed fixture; minimum 63 for open fixture

    2. 400-999 watts: minimum 82 LER for closed fixture; minimum 89 for open fixture

    3. 1000+ watts: minimum 109 LER for open fixture

c. Upward efficiency of 11% to 20%

1. 150-399 watts: minimum 78 LER for open fixture

2. 400-999 watts: minimum 94 for open fixture

d. Upward efficiency greater than 20%

1. 150-399 watts: minimum 75 LER for closed fixture; minimum 77 for open fixture

2.2.1.2 Metal-Halide Lamps

Provide luminaires with tempered glass lens.

a. Single-ended, wattage as indicated, conforming to NEMA C78.43

Lamps shall have Luminaire Efficiency Ratings (LER) as follows:

a. Upward efficiency of 0%

1. 150-399 watts: minimum 41 LER for closed fixture

2. 400-999 watts: minimum 53 LER for closed fixture; minimum 59 for open fixture

3. 1000+ watts: minimum 77 LER for closed fixture

b. Upward efficiency of 1%-10%

1. 150-399 watts: minimum 56 LER for closed fixture

2. 400-999 watts: minimum 62 LER for closed fixture; minimum 64 for open fixture

3. 1000+ watts: minimum 88 LER for open fixture

c. Upward efficiency greater than 20%

1. 150-399 watts: minimum 62 LER for closed fixture; minimum 77 for open fixture

2. 400-999 watts: minimum 65 LER for closed fixture

2.2.2 Ballasts for High-Intensity-Discharge (HID) Luminaires

UL 1029 and NEMA C82.4, and shall be constant wattage autotransformer (CWA) or regulator, high power-factor type (minimum 90%). Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts shall be:

a. Designed to operate on voltage system to which they are connected.

b. Constructed so that open circuit operation will not reduce the average life.

HID ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 degrees C.

2.3 LIGHTING CONTACTOR

NEMA ICS 2, mechanically held contactor. Rate contactor as indicated. Provide in NEMA 4 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts and coil clearing contacts for mechanically held contactor and shall require no arcing contacts. Provide contactor with hand-off-automatic selector switch.

2.4 TIME SWITCH

Astronomic dial type or electronic type, arranged to turn "ON" at sunset, and turn "OFF" at predetermined time between 8:30 p.m. and 2:30 a.m. or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide switch rated 208 volts, having automatically wound spring mechanism or capacitor, to maintain accurate time for a minimum of 7 hours following power failure. Provide time switch with a manual on-off bypass switch. Housing for the time switch shall be surface mounted, NEMA 1 enclosure conforming to NEMA ICS 6.

2.5 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 208 volts ac, 60 Hz with single-throw contacts designed to fail to the ON position. Switch shall turn on at or below 3 footcandles and off at 4 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition. Provide switch:

a. Integral to the luminaire, rated 1000 VA, minimum.

2.6 POLES

Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS-4 while supporting luminaires and all other appurtenances indicated.The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws. Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole. Scratched, stained, chipped, or dented poles shall not be installed.

2.6.1 Aluminum Poles

Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a round or tapered cover. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B 108 and shall be machined to receive the lower end of shaft.Joint between shaft and base shall be

welded. Base cover shall be cast 356-T6 aluminum alloy in accordance with ASTM B 108. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel. Manufacturer's provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

2.7 BRACKETS AND SUPPORTS

NEMA C136.3, NEMA C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

2.8 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A 153/A 153M. Concrete shall be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.9 EQUIPMENT IDENTIFICATION

2.9.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. Luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only_____":

a. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

c. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

d. ANSI ballast type (M98, M57, etc.) for HID luminaires.

e. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.10 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Aluminum Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3.1.2 Pole Setting

Depth shall be as indicated. Poles in straight runs shall be in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6 inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

3.1.3 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.1.4 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.1.5 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

SECTION 27 05 14.00 10

CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 SYSTEM DESCRIPTION

Provide a cable TV premises distribution system consisting of coaxial cables, amplifiers, and connecting hardware for the transport of television signals throughout the building to user locations as indicated.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Test Plan;
Qualifications;

SD-06 Test Reports

Testing

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

1.4 QUALIFICATIONS

Submit proof of the qualifications of the Contractor, Installers, and Manufacturers that will perform the work, and provide the specified products.

1.4.1 Minimum Contractor Qualifications

Work under this section shall be performed, and equipment shall be furnished and installed, by a qualified Contractor as defined herein. The Contractor shall have a minimum of two years of experience in the installation and testing of coaxial cable-based TV distribution systems and equipment. Installers assigned to the installation of this system or its components shall have a minimum of two years of experience in the installation of the specified coaxial cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract shall be products of manufacturers that have a minimum of two years of experience in producing the types of systems and equipment specified.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.6 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that are the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70. Cables shall be labeled on both ends with circuit number, room number, or other appropriate marking allowing for correct identification of the cable and its destination. Each faceplate shall be labeled with its function and a unique number to identify the cable run.

2.1.1 Coaxial Cable

Coaxial cable shall be RG-6/U, quad shield. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals identifying cable type. Cable shall be rated CMP in accordance with NFPA 70. Interconnecting cables shall be cable assemblies consisting of RG-6/U coaxial cable with male connectors at each end, provided in lengths determined by equipment locations as shown.

2.1.2 Outlets

Cable television outlets, including wall outlet plates, shall be equipped with a female connector to accept the connecting coaxial cable from the user's television set. Faceplates provided shall be ivory resistant plastic.

2.1.3 Outlet Boxes

Electrical boxes for cable television outlets shall be 4-11/16 inch square by 2-1/4 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Conduits shall be minimum 1 inch.

PART 3 EXECUTION

3.1 INSTALLATION

Install system components and appurtenances in accordance with NFPA 70, manufacturer's instructions and as shown. Provide necessary interconnections, services, and adjustments required for a complete cable television distribution system, ready to connect to external television signal sources. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07 84 00 FIRESTOPPING. Install conduits, outlets, raceways, and wiring in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Cables and outlets shall be individually labeled and marked. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Cable Installation

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Cable not in a wireway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated unless shown otherwise. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. Provide 20 foot long service loop in telecommunication rooms.

3.1.2 Cables

Cables shall have a minimum of 6 inches of slack cable loosely coiled into the cable television outlet boxes. Minimum manufacturer's bend radius shall not be exceeded.

3.1.3 Pull Cords

Pull cords shall be installed in conduits serving the cable television premises distribution system which do not initially have cable installed.

3.2 TERMINATIONS

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. Coaxial cables shall be terminated with appropriate connectors as required. Cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.3 GROUNDING

The cable television distribution system ground shall be installed in the cable television entrance facility and in any auxiliary closet identified in

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM or otherwise indicated. Equipment racks shall be connected to the electrical safety ground.

3.4 TESTING

Submit test reports in booklet form with witness signatures verifying execution of tests. The cable system testing documentation shall include the physical routing and a test report for each cable (end-to-end) from the installed outlet to the main termination point. Test reports shall be submitted within 14 days after completion of testing. Materials and documentation to be furnished under this specification are subject to inspections and tests.

a. Submit a Test Plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 30 days prior to the proposed test date. The plan shall be approved before testing begins. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

b. Components shall be terminated prior to testing.

c. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the cable television premises distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

d. After installation of the cable and before connecting system components, each cable section shall be end-to-end tested using a time domain reflectometer (TDR) to determine shorts, opens, kinks, and other impedance discontinuities and their locations. Cable sections showing adverse impedance discontinuities (greater than 6 dB loss) shall be replaced at the Contractor's expense.

e. There shall be no cable splices between system components unless approved by the Government.

3.5 OPERATION AND MAINTENANCE MANUALS

SD-10 Submit commercial, off-the-shelf manuals for operation, installation, configuration, and maintenance of products provided as a part of the cable television premises distribution system. Specification sheets for cable, connectors, and other equipment shall be provided as specified in the Submittals paragraph.

-- End of Section --

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-90-661	(2008) Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables for Use in General Purpose and LAN Communications Wiring Systems Technical Requirements

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA/BICSI 568	(2006) Standard for Installing Building Telecommunications Cabling

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66	(2001; Errata 2003) Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA J-STD-607	(2002a) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
TIA-1152	(2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

TIA-568-C.0	(2009; Add 1 2010) Generic Telecommunications Cabling for Customer Premises
TIA-568-C.1	(2009) Commercial Building Telecommunications Cabling Standard
TIA-568-C.2	(2009; Errata 2010) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568-C.3	(2008; Corrections 2008) Optical Fiber Cabling Components Standard
TIA-569	(2004b; Add 1 2009) Commercial Building Standard for Telecommunications Pathways and Spaces
TIA/EIA-606	(2002a; Errata 2007; R 2007; Adm 1 2008) Administration Standard for the Telecommunications Infrastructure

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68	Connection of Terminal Equipment to the Telephone Network (47 CFR 68)

UNDERWRITERS LABORATORIES (UL)

UL 1286	(2008; Reprint Jan 2011) Office Furnishings
UL 1863	(2004; Reprint Aug 2008) Communication Circuit Accessories
UL 444	(2008; Reprint Apr 2010) Communications Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(1995; Reprint Nov 2008) Standard for Marking and Labeling Systems

1.2 RELATED REQUIREMENTS

Technical Criteria for the Installation Information Infrastructure Architecture (I3A) applies to this section.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA/EIA-606 and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

1.3.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.3.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.7 Open Cable

Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed horizontal cabling, horizontal pathways, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a

building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.5 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Telecommunications cabling (horizontal);

Patch panels;

Telecommunications outlet/connector assemblies;

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing;

SD-07 Certificates

Telecommunications Contractor Qualifications;

Test plan;

1.6 QUALITY ASSURANCE

1.6.1 Not used

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation,

and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.2.2 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, 30 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size.The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package 5.

PART 2 PRODUCTS

2.1 COMPONENTS

Comments shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569. Provide system furniture pathways in accordance with UL 1286.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and NFPA 70. Provide a labeling system for cabling as required by TIA/EIA-606 and UL 969. Ship cable on reels or in boxes bearing manufacture date for unshielded twisted pair (UTP) in accordance with ICEA S-90-661 for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.3.1 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568-C.1.

2.3.1.1 Horizontal Copper

Provide horizontal copper cable, UTP, 100 ohm in accordance with TIA-568-C.2, UL 444, ANSI/NEMA WC 66, ICEA S-90-661. Provide four each individually twisted pair, minimum size 24 AWG conductors, Category 6, with a thermoplastic jacket. Provide a blue jacket for voice and a yellow jacket for data. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with ICEA S-90-661. Provide plenum (CMP) communications rated cabling in accordance with NFPA 70. Cables installed in conduit within and under slabs shall be UL listed and labeled for wet locations in accordance with NFPA 70.

2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility and telecommunication equipment room to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with TIA/EIA-606.

2.4.1 Backboards

Provide void-free, interior grade A-C plywood 3/4 inch thick 4 by 8 feet. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible. Backboards shall be provided on a minimum of two adjacent walls in the telecommunication spaces.

2.4.2 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 6 systems. Provide blocks for the number of horizontal cables terminated on the block plus 25 percent spare.

2.4.3 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on equipment racks cabinets and telecommunications backboards.

2.4.4 Patch Panels

Provide ports for the number of horizontal cables terminated on the panel plus 25 percent spare. Provide pre-connectorized copper patch cords for patch panels, one for each connected port. Provide patch cords, as complete assemblies, with matching connectors as specified, 7 feet in length with blue jacket. Patch cords shall meet minimum performance requirements specified in TIA-568-C.1, TIA-568-C.2 for cables, cable length and hardware specified.

2.4.4.1 Modular to 110 Block Patch Panel

Provide in accordance with TIA-568-C.1 and TIA-568-C.2. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Panel shall be constructed of 0.09 inches minimum aluminum and shall be rack mounted and compatible with an existing equipment cabinet. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568B(verify and match existing wiring method). Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68, TIA-568-C.1, and TIA-568-C.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568-C.2 Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired as indicated in subparagraph, Modular to 110 Block Patch Panel. UTP outlet/connectors shall comply with TIA-568-C.2 for 200 mating cycles.Provide pre-connectorized patch cords, one for each port, 12 feet in length with blue jacket.

2.5.2 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568-C.1, TIA-568-C.2; flush design constructed of high impact thermoplastic material ivory in color to match color. Provide labeling in accordance with the paragraph LABELING in this section.

2.6 GROUNDING AND BONDING PRODUCTS

Provide in accordance with UL 467, TIA J-STD-607, and NFPA 70. Components shall be identified as required by TIA/EIA-606. Provide ground rods, bonding conductors, and grounding busbars.

2.7 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.8 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when

applicable, the position. Nameplates shall be melamine plastic, 0.125 inches thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inches high normal block style.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with NECA/BICSI 568, TIA-568-C.1, TIA-568-C.2, TIA-569, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.

3.1.1 Cabling

Install UTP, telecommunications cabling system as detailed in TIA-568-C.1, TIA-568-C.2. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays. Install in accordance with TIA-568-C.1, TIA-568-C.2.Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

Plenum cable shall be used where open cables are routed through plenum areas. Plenum cables shall comply with flammability plenum requirements of NFPA 70.

3.1.1.2 Horizontal Cabling

Install horizontal cabling as indicated on drawings Do not untwist Category 6 UTP cables more than one half inch from the point of termination to

maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, 10 feet in the telecommunications room, and 12 inches in the work area outlet.

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70.

3.1.3 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only CMP type cable shall be installed in a plenum.

3.1.4 Work Area Outlets

3.1.4.1 Terminations

Terminate UTP cable in accordance with TIA-568-C.1, TIA-568-C.2 and wiring configuration as specified.

3.1.4.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.4.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.4.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.5 Telecommunications Space Termination

Install termination hardware required for Category 6 system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

3.1.5.1 Connector Blocks

Connector blocks shall be wall mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with TIA-569.

3.1.5.2 Patch Panels

Patch panels shall be mounted in equipment cabinets provided by FLETC. Provide sufficient ports to accommodate the installed cable plant plus 25 percent spares.

a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel with cable ties to prevent movement of the cable.

3.1.5.3 Equipment Support Frames

Install in accordance with TIA-569:

a. Cabinets, freestanding modular type. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets.

3.1.6 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

3.1.7 Grounding and Bonding

Provide in accordance with TIA J-STD-607, NFPA 70.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA/EIA-606. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process or laser printer.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA/EIA-606.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA/EIA-606.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

If backboards are required to be painted, then the manufactured fire retardant backboard must be painted with fire retardant paint, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be unpainted.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1, TIA-568-C.2. Test equipment shall conform to TIA-1152.

3.5.1.1 Inspection

Visually inspect UTP jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross-connected.

3.5.1.3 Performance Tests

Perform testing for each outlet as follows:

a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

3.5.1.4 Final Verification Tests

Perform verification tests for UTP systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

a. Voice Tests.These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --

SECTION 28 31 64.00 10

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1221	(2010) Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code
NFPA 72	(2010; TIA 10-4) National Fire Alarm and Signaling Code
NFPA 90A	(2009; Errata 09-1) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2006; Reprint Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL 268	(2009) Smoke Detectors for Fire Alarm Systems

UL 268A	(2008; Reprint Sep 2009) Smoke Detectors for Duct Application
UL 38	(2008; Reprint Dec 2008) Manual Signaling Boxes for Fire Alarm Systems
UL 464	(2009; Reprint Jan 2011) Standard for Audible Signal Appliances
UL 521	(1999; Reprint May 2010) Heat Detectors for Fire Protective Signaling Systems
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 864	(2003; Reprint Jan 20110) Standard for Control Units and Accessories for Fire Alarm Systems

1.2 SYSTEM DESCRIPTION

The fire detection and alarm system and the central reporting system shall be a complete, supervised fire alarm reporting system configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. Furnish equipment compatible and UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards. Locks shall be keyed alike. Provide four keys for the system. Furnish tags with stamped identification number for keys and locks.

1.2.1 Operation

Activate the system into the alarm mode by actuation of any alarm initiating device. The system will remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm and supervisory initiating devices shall be individually addressable. Alarm initiating devices shall be connected to initiating device circuits (IDC), Class B, to signal line circuits (SLC), Classe B, in accordance with NFPA 72. Connect alarm notification appliances to notification appliance circuits (NAC), Class A in accordance with NFPA 72. Provide a looped conduit system so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

a. Sufficient memory to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors.

c. Capability of each addressable device being individually disabled or enabled from the panel.

d. Size each SLC to provide 40 percent addressable expansion without hardware modifications to the panel.

1.2.2 Operational Features

The system shall have the following operating features:

a. Monitor electrical supervision of IDC, SLC, and NAC circuits.

b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. Submit Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.

f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD displays on the control panel nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.

g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.

h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.

i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.

k. The fire alarm control panel shall monitor and control the fire sprinkler system, fire pump controllers, or other fire protection extinguishing system.

l. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

n. Fire alarm shall be arranged as indicated on the contract drawings.

1.2.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the functions shown on the design drawings.

1.2.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.2.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.2.6 Interface With Existing Fire Alarm Equipment

The entire existing fire alarm system including all panels shall be demolished after the new system has been accepted.

1.2.7 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc. Components shall also be

compatible with proprietary supervising station receiving equipment (Bosch D6600).

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Storage Batteries
Low Battery Voltage
Special Tools and Spare Parts
Technical Data and Computer Software
Training
Testing

SD-06 Test Reports

Testing

SD-07 Certificates

Equipment
Qualifications

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions;

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Submit proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

1.4.1.1 Engineer and Technician

a. Registered Professional Engineer in the State of Georgia with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.4.1.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.4.1.3 Fire Protection Engineer

The fire protection engineer shall be registered in the State of Georgia.

1.4.2 Detail Drawings

Submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical audible appliances. Check the layout based on the actual audible devices to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detail drawings and detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

a. Identification of programmable portions of system equipment and capabilities.

b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

c. Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.

d. Description of Fire Alarm Control Panel equipment operation.

e. Description of auxiliary and remote equipment operations.

f. Library of application software.

g. Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

1.7 SPECIAL TOOLS AND SPARE PARTS

Submit spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service. Furnish software, connecting cables, proprietary equipment and two spare fuses of each type and size required, necessary for the maintenance, testing, and reprogramming of the equipment. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Mount spare fuses in the fire alarm panel.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

2.2 NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

2.3 FIRE ALARM CONTROL PANEL

The Fire Alarm Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches.

a. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices

(meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system.

b. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other devices. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

c. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units.Cabinets shall be painted red.

2.3.1 Circuit Connections

Connect circuit conductors entering or leaving the panel to screw-type terminals with each conductor and terminal marked for identification.

2.3.2 System Expansion and Modification Capabilities

Provide, as part of this contract, any equipment and software needed by qualified technicians to implement future changes to the fire alarm system.

2.3.3 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Class B notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.3.4 Addressable Initiating Device Circuits Module

Configure the initiating device being monitored as a Class B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time

the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.4 STORAGE BATTERIES

Submit substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included. Provide storage batteries which are 24 Vdc sealed, lead-calcium type requiring no additional water with ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 24 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 5 minutes. Locate batteries at the bottom of the panel. Provide batteries with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Paint the cabinets to match the fire alarm control panel.

2.5 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Locate charger in control panel cabinet or in a separate battery cabinet.

2.6 FIRE ALARM MANUAL STATIONS

Fire alarm manual stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on surface mounted outlet boxes. Manual stations shall be mounted at 48 inches. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations.

2.7 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually

addressable, except where indicated. Installed devices shall conform to NFPA 70 hazard classification of the area where devices are to be installed.

2.7.1 Smoke Detectors

Design smoke detectors for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location. Smoke detector shall be provided above panel in Fire Pump Room.

2.7.1.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.7.1.2 Duct Smoke Detectors

Duct smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.8 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be

painted red. Recessed audible appliances shall be installed with a grill that is painted red.

2.8.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.8.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 15 candela, but shall be sized as shown on drawings. Strobe shall be surface mounted.

2.8.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.9 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.9.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.9.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 16 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

2.10 TRANSMITTERS

2.10.1 Digital Alarm Communicator Transmitters (DACT)

Transmitters shall be compatible with proprietary supervising station receiving equipment (Bosch D6600). Each transmitter shall be the

manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is Bosch D6600 through windows based management Mastermind and the transceiver shall be fully compatible with this equipment. At the Contractors option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel. The DACT shall receive an alarm, supervisory, or trouble signal from the control unit and automatically capture two telephone lines(s) and dial a preset number for a remote central station. When contact is made with the central station, signals shall be transmitted in contact ID protocol. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station.

2.10.1.1 Transmitter Power Supply

Each transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery in addition to manufacturers operation power requirements.

a. Operation: Each transmitter shall operate from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall also be automatic.

b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 24 hours and be capable of transmitting alarms during that period.

2.10.1.2 Digital Alarm Communicator Transmitter Housing

Transmitter housing shall be NEWMAN Type 1. The housing shall contain a lock that is keyed identical to the fire alarm system for the building. Digital alarm communicator transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.11 FIRE ALARM ANNUNCIATOR

2.11.1 FIRE ALARM ANNUNCIATOR PANEL

Provide an annunciator that includes an LCD display. The display shall indicate the device in trouble/alarm or any supervisory device. Display the device name, address, and actual building location. A building floor plan shall be provided mounted (behind plexiglass or similar protective material) at the annunciator location. The floor plan shall indicate all rooms by name and number including the locations of stairs and elevators.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

Install all work as shown, in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.2.1 Power Supply for the System

Provide a single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system panel. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.2.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.2.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. Manually operable controls shall be between 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.2.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be

provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location.

3.2.5 Notification Appliances

Notification appliances shall be mounted 80 inches above the finished floor or 6 inches below the ceiling, whichever is lower.

3.2.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.2.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in Section 21 13 13.00 10 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, as indicated on the drawings and as specified herein.

3.2.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall he mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in Section 21 13 13.00 10 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, as indicated on the drawings and as specified herein.

3.3 OVERVOLTAGE AND SURGE PROTECTION

3.3.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.3.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.3.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.4 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.5 TRAINING

Submit lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. Conduct the course in the building where the system is installed or as designated by the Contracting Officer.

a. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system. Provide training course for the maintenance staff.The training period for system expansions and modifications shall consist of at least 1/2 training day (4 hours) and shall start after the system is functionally completed but prior to final acceptance tests.

3.6 TESTING

Notify the Contracting Officer and the Fire Protection Engineer at least 10 days before the preliminary and acceptance tests are to be conducted. Perform the tests in accordance with the approved test procedures in the

presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. Furnish instruments and personnel required for the tests. The Fire Protection Engineer needs to be present and sign off on all testing conducted for the fire protection systems.

a. Submit detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

b. Submit test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. Include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

3.6.1 Preliminary Tests

Upon completion of the installation, subject the system to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. Conduct the megger test prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing complete and submit the NFPA 72, Certificate of Completion and Testing Form.

3.6.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Conduct testing in accordance with NFPA 72. The recommended tests in NFPA 72 are considered mandatory and shall verify that previous deficiencies have been corrected. The Fire alarm Technician supervising the installation of the fire alarm system shall attend the testing of the system. The test shall include all requirements of NFPA 72 and the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of each alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault each circuit.

k. Short circuit faults each circuit.

l. Stray voltage test.

m. Loop resistance test.

-- End of Section --

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 MEASUREMENT PROCEDURES

1.2 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Material character is indicated by the boring logs.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA P5	(2009) Standard for Waterborne Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM A139/A139M	(2004; R 2010) Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and over)

ASTM A252	(2010) Standard Specification for Welded and Seamless Steel Pipe Piles
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM D1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.4 DEFINITIONS

1.4.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SC, CL, ML, CL-ML. Satisfactory materials for grading comprise stones less than 1.5 inches in any dimension.

1.4.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and

material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.4.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136, ASTM D422, and ASTM D1140.

1.4.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.4.5 Topsoil

Material suitable for topsoils obtained from offsite areas and excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.4.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.4.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.4.8 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.4.9 Select Granular Material

1.4.9.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, or SP by ASTM D2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index must not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D1140.

1.4.10 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 1.5 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 1.5 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.4.11 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 15 when tested in accordance with ASTM D4318.

1.5 SYSTEM DESCRIPTION

Subsurface soil boring logs are appended to the SPECIAL CONTRACT REQUIREMENTS. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.5.1.2 Rock Excavation

Submit notification of encountering rock in the project. Include rock excavation with blasting, excavating, grading, disposing of material classified as rock, and the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove

without systematic drilling and blasting; and hard materials (see Definitions). Include the removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic yard in volume that may be encountered in the work in this classification.If at any time during excavation, the Contractor encounters material that may be classified as rock excavation, uncover such material and notify the Contracting Officer. Do not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.5.2 Blasting

Blasting will not be permitted.

1.5.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.6 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Testing
Borrow Site Testing

SD-07 Certificates

Testing

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1.Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Within 24 hours of conclusion of physical tests, submit 3 copies of test results, including calibration curves and results of calibration tests. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

Provide Bedding material, Filter fabric and rock conforming to these requirements for construction indicated.

2.4.1 Bedding Material

Provide bedding material consisting of sand, gravel, or crushed rock, well graded, with a maximum particle size of 2 inches. Compose material of tough, durable particles. Allow fines passing the No. 200 standard sieve with a plasticity index less than six.

2.4.2 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Provide rock with a minimum specific gravity of 2.50. Do not permit the inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines.

2.5 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Conform to ASTM C33/C33M for fine aggregate grading with a maximum of 3 percent by weight passing ASTM D1140, No. 200 sieve, or 1-1/2 inch and no more than 2 percent by weight passing the No. 4 size sieve or coarse aggregate Size 57, 67, or 77.

2.6 PIPE CASING

2.6.1 Casing Pipe

ASTM A139/A139M, Grade B, or ASTM A252, Grade 2, smooth wall pipe. Match casing size to the outside diameter and wall thickness as indicated on the plans. Protective coating is not required on casing pipe.

2.6.2 Wood Supports

Locally available, rough, structural grade. Provide wood with nonleaching water-borne pressure preservative (ACA or CCA) and treatment conforming to AWPA P5 and AWPA C2, respectively. Secure wood supports to carrier pipe with stainless steel or zinc-coated steel bands.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Remove from the site any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the

limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the plans. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation

and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 2 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete.

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter.Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.5.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

3.3 SHORING

3.3.1 General Requirements

Submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.4 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and wasted materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.5 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.6 GROUND SURFACE PREPARATION

3.6.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.6.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.7 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Do not waste any satisfactory excavated material without specific

written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.8 BURIED TAPE AND DETECTION WIRE

3.8.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.8.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over it's entire length.Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.9 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9.1 Trench Backfill

Backfill trenches to the grade shown. Do not backfill the trench until all specified tests are performed.

3.9.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.9.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.9.1.3 Bedding and Initial Backfill

Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ASTM D698 maximum density.Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

a. Class I: Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.9.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, with satisfactory material. Place backfill material and compact as follows:

a. Roadways, Railroads, and Airfields: Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.9.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.10 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.10.1 Rip-Rap Construction

Construct rip-rap on filter fabric in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.10.1.1 Bedding Placement

Spread filter fabric bedding material uniformly to a thickness of at least 3 inches on prepared subgrade as indicated.

3.10.1.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.11 SUBGRADE PREPARATION

3.11.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Proof roll the existing subgrade of the parking areas with six passes of a 3-1/2 ton pneumatic-tired roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2-1/2 to 3-1/2 mph. Provide one-half of the passes made with the roller in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material and replace with select material.

3.11.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inches below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.11.3 Compaction

Finish compaction by pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 90 percent of laboratory maximum density.

3.11.3.1 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 6 inches of subgrade.

3.12 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.12.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.12.2 Capillary Water Barrier

Place a capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.12.3 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.13 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 4 inches and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.14 TESTING

Perform testing by a Government validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the

testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Government validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with ASTM D1556.

b. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.14.1 Fill and Backfill Material Gradation

One test per 500 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136.

3.14.2 In-Place Densities

a. One test per 1500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 1500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

3.14.3 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.14.4 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material to determine the optimum moisture and laboratory maximum density values. One representative test per 100 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.14.5 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.14.6 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 36 inches, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras

passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.15 DISPOSITION OF SURPLUS MATERIAL

Provide surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber as removed from Government property as directed by the Contracting Officer.

-- End of Section --

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section 01 57 50, TEMPORARY ENVIRONMENTAL CONTROLS. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer's Technical Representative immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer's Technical Representative in ample time to minimize interruption of the service.

3.2 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.3 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.4 DISPOSAL OF MATERIALS

3.4.1 Nonsaleable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

-- End of Section --

SECTION 31 31 16

SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

7 USC Section 136	Federal Insecticide, Fungicide, and Rodenticide Act

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Termiticide Application Plan; G

Termiticide application plan with proposed sequence of treatment work with dates and times. The termiticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area/volume treated, amount applied; and the name and state license number of the state certified applicator shall be included.

Termiticides; G

Manufacturer's label and Material Safety Data Sheet (MSDS) for termiticides proposed for use.

Foundation Exterior

Written verification that other site work will not disturb the treatment.

Utilities and Vents

Written verification that utilities and vents have been located.

Verification of Measurement

Written verification that the volume of termiticide used meets the application rate.

Application Equipment

A listing of equipment to be used.

Warranty; G

Copy of Contractor's warranty.

SD-06 Test Reports

Soil Moisture

Soil moisture test result.

Quality Assurance

Pest Management Report and copies of daily records signed by an officer of the Contractor.

SD-07 Certificates

Qualifications; G

Qualifications and state license number of the termiticide applicator.

1.3 QUALIFICATIONS

For the application of pesticides, the Contractor shall use the services of a subcontractor whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed. Termiticide applicators shall also be certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control.

1.4 SAFETY REQUIREMENTS

Formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Contracting Officer's Technical Representative, and fit the filling hose with a backflow preventer meeting local plumbing codes or standards. The filling operation shall be under the direct and continuous observation of a contractor's representative to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application. Dispose of used pesticide containers off Government property.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Termiticide material shall be delivered to the site in the original unopened containers bearing legible labels indicating the EPA registration number and manufacturer's registered uses. All other materials to be used on site for

the purpose of termite control shall be delivered in new or otherwise good condition as supplied by the manufacturer or formulator.

1.5.2 Storage

Materials shall be stored in designated areas and in accordance with manufacturer's labels. Termiticides and related materials shall be kept under lock and key when unattended.

1.5.3 Handling

Termiticides shall be handled in accordance with manufacturer's labels. Manufacturer's warnings and precautions shall be observed. Materials shall be handled preventing contamination by dirt, water, and organic material. Protect termiticides from sunlight as recommended by the manufacturer.

1.6 INSPECTION

Termiticides shall be inspected upon arrival at the job site for conformity to type and quality in accordance with paragraph TERMITICIDES. Each label shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or under appropriate regulations of the host county. Other materials shall be inspected for conformance with specified requirements. Unacceptable materials shall be removed from the job site.

1.7 WARRANTY

The Contractor shall provide a 5-year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Warranty shall include annual inspections of the buildings or building additions. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim, the Contractor shall:

a. Retreat the soil and perform other treatment as may be necessary for elimination of subterranean termite infestation;

b. Repair damage caused by termite infestation; and

c. Reinspect the building approximately 180 days after the retreatment.

1.8 QUALITY ASSURANCE

The Contractor shall comply with 7 USC Section 136 for requirements on contractor's licensing, certification, and record keeping. The Contractor shall maintain daily records using Pest Management Maintenance Record, DD Form 1532-1 and submit copies of records when requested by the Contracting Officer's Technical Representative.

Upon completion of this work, submit Pest Management Report. DD Form 1532 identifying target pest, type of operation, brand name and manufacturer of pesticide, formulation, concentration or rate of application used.

PART 2 PRODUCTS

2.1 TERMITICIDES

Termiticides shall be currently registered by the EPA or approved for such use by the appropriate agency of the host county. Non-repellant termiticide shall be selected for maximum effectiveness and duration after application. The selected termiticide shall be suitable for the soil and climatic conditions at the project site.

PART 3 EXECUTION

3.1 TECHNICAL REPRESENTATIVE

The certified installation pest management coordinator shall be the technical representative, shall be present at all meetings concerning treatment measures for subterranean termites, and may be present during treatment application. The command Pest Control Coordinator shall be contacted prior to starting work.

3.2 SITE PREPARATION

Work related to final grades, landscape plantings, foundations, or any other alterations to finished construction which might alter the condition of treated soils, shall be coordinated with this specification.

3.2.1 Ground Preparation

Food sources shall be eliminated by removing debris from clearing and grubbing and post construction wood scraps such as ground stakes, form boards, and scrap lumber from the site, before termiticide application begins.

3.2.2 Verification

Before work starts, the Contractor shall verify that final grades are as indicated and smooth grading has been completed in accordance with Section 31 00 00 EARTHWORK. Soil particles shall be finely graded with particles no larger than 1 inch and compacted to eliminate soil movement to the greatest degree.

3.2.3 Foundation Exterior

The Contractor shall provide written verification that final grading and landscape planting operations will not disturb treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures.

3.2.4 Utilities and Vents

The Contractor shall provide written verification that the location and identity of HVAC ducts and vents, water and sewer lines, and plumbing have been accomplished prior to the termiticide application.

3.3 SITE CONDITIONS

The following conditions shall determine the time of application.

3.3.1 Soil Moisture

Soils to be treated shall be tested immediately before application. Soil moisture content shall be tested to a minimum depth of 3 inches. The soil moisture shall be as recommended by the termiticide manufacturer. The termiticide will not be applied when soil moisture exceeds manufacturer's recommendations because termiticides do not adhere to the soil particles in saturated soils.

3.3.2 Runoff and Wind Drift

Termiticide shall not be applied during or immediately following heavy rains. Applications shall not be performed when conditions may cause runoff or create an environmental hazard. Applications shall not be performed when average wind speed exceeds 10 miles per hour. The termiticide shall not be allowed to enter water systems, aquifers, or endanger humans or animals.

3.3.2.1 Vapor Barriers and Waterproof Membranes

Termiticide shall be applied prior to placement of a vapor barrier or waterproof membrane.

3.3.2.2 Utilities and Vents

Prior to application, HVAC ducts and vents located in treatment area shall be turned off and blocked to protect people and animals from termiticide.

3.3.3 Placement of Concrete

Concrete covering treated soils shall be placed as soon as the termiticide has reached maximum penetration into the soil. Time for maximum penetration shall be as recommended by the manufacturer.

3.4 TERMITICIDE TREATMENT

The Contractor shall submit a Termiticide Application Plan for approval before starting the specified treatment.

3.4.1 Equipment Calibration and Tank Measurement

Immediately prior to commencement of termiticide application, calibration tests shall be conducted on the application equipment to be used and the application tank shall be measured to determine the volume and contents. These tests shall confirm that the application equipment is operating within the manufacturer's specifications and will meet the specified requirements. The Contractor shall provide written certification of the equipment calibration test results within 1 week of testing.

3.4.2 Mixing and Application

Formulating, mixing, and application shall be performed in the presence of the Contracting Officer's Technical Representative or the technical representative. A closed system is recommended as it prevents the termiticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation.

Prior to each day of use, the equipment used for applying termiticides shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.4.3 Treatment Method

For areas to be treated, the Contractor shall establish complete and unbroken vertical and/or horizontal soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Application shall not be made to areas which serve as crawl spaces or for use as a plenum air space.

3.4.3.1 Surface Application

Surface application shall be used for establishing horizontal barriers. Surface applicants shall be applied as a coarse spray and provide uniform distribution over the soil surface. Termiticide shall penetrate a minimum of 1 inch into the soil, or as recommended by the manufacturer.

3.4.3.2 Rodding and Trenching

Rodding and trenching shall be used for establishing vertical soil barriers. Trenching shall be to the depth of the foundation footing. Width of trench shall be as recommended by the manufacturer, or as indicated. Rodding or other approved method may be implemented for saturating the base of the trench with termiticide. Immediately after termiticide has reached maximum penetration as recommended by the manufacturer, backfilling of the trench shall commence. Backfilling shall be in 6 inch rises or layers. Each rise shall be treated with termiticide.

3.4.4 Sampling

The Contracting Officer's Technical Representative may draw from stocks at the job site, at any time and without prior notice, samples of the termiticides used to determine if the amount of active ingredient specified on the label is being applied.

3.5 VERIFICATION OF MEASUREMENT

Once termiticide application has been completed, tank contents shall be measured to determine the remaining volume. The total volume measurement of used contents for the application shall equal the established application rate for the project site conditions. The Contractor shall provide written verification of the measurements.

3.6 CLEAN UP, DISPOSAL, AND PROTECTION

Once application has been completed, the Contractor shall proceed with clean up and protection of the site without delay.

3.6.1 Clean Up

The site shall be cleaned of all material associated with the treatment measures, according to label instructions, and as indicated. Excess and waste material shall be removed and disposed off site.

3.6.2 Disposal of Termiticide

The Contractor shall dispose of residual termiticides and containers off Government property, and in accordance with label instructions and EPA criteria.

3.6.3 Protection of Treated Area

Immediately after the application, the area shall be protected from other use by erecting barricades and providing signage as required or directed. Signage shall be in accordance with Section 10 14 01 EXTERIOR SIGNAGE. Signage shall be placed inside the entrances to crawl spaces and shall identify the space as treated with termiticide and not safe for children and animals.

3.7 CONDITIONS FOR SATISFACTORY TREATMENT

3.7.1 Equipment Calibrations and Measurements

Where results from the equipment calibration and tank measurements tests are unsatisfactory, re-treatment will be required.

3.7.2 Testing

Should an analysis, performed by a third party, indicate that the samples of the applied termiticide contain less than the amount of active ingredient specified on the label, and/or if soils are treated to a depth less than specified or approved, re-treatment will be required.

3.7.3 Disturbance of Treated Soils

Soil and fill material disturbed after treatment shall be re-treated before placement of slabs or other covering structures.

3.7.4 Termites Found Within the Warranty Period

If live subterranean termite infestation or termite damage is discovered during the warranty period, the Contractor shall re-treat the site.

3.8 RE-TREATMENT

Where re-treatment is required, the Contractor shall comply with the requirements specified in paragraph WARRANTY.

-- End of Section --

SECTION 32 05 33

LANDSCAPE ESTABLISHMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush

ASTM INTERNATIONAL (ASTM)

ASTM D 2103	(2005) Standard Specification for Polyethylene Film and Sheeting
ASTM D 5851	(1995; R 2006) Planning and Implementing a Water Monitoring Program

1.2 DEFINITIONS

1.2.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.2.2 Stand of Turf

95 percent ground cover of the established species.

1.2.3 Planter Beds

A planter bed is defined as an area containing one or a combination of the following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, and a mulch topdressing excluding turf. Trees may also be found in planter beds.

1.3 RELATED REQUIREMENTS

Section 32 92 23 SEEDING applies to this section for installation of seed requirements, with additions and modifications herein.

Section 32 93 00 EXTERIOR PLANTS applies to this section for installation of trees, and shrubs, with additions and modifications herein.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

Deliver fertilizer, gypsum, and iron to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, and gypsum may be furnished in bulk with a certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Fertilizer, Lime, Iron, Mulch Storage

Material shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants.

1.5.2.2 Antidessicants Storage

Do not store with fertilizers or other landscape maintenance materials.

1.5.3 Handling

Do not drop or dump materials from vehicles.

1.6 MAINTENANCE

Provide instructions and procedures for watering; promotion of growth, including fertilizing, pruning, and mowing; and integrated pest management. O&M Manuals shall include pictures of planting materials cross referenced to botanical and common names, with a description of the normal appearance in each season.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

Fertilizer for grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.1.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus

8 percent available potassium

2.2 WATER

Source of water shall be approved by the Contracting Officer's Technical Representative, and be of suitable quality for irrigation. Use collected storm water or graywater when available.

2.3 MULCHES TOPDRESSING

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.3.1 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark or shredded hardwood from site when available. Biobased content shall be a minimum of 100 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application. Paper-based hydraulic mulch shall contain a minimum of 100 percent post-consumer recycled content. Wood-based hydraulic mulch shall contain a minimum of 100 percent recycled material.

2.4 PESTICIDES

Pesticides and herbicides are not permitted. Use black sheet polyethylene conforming to ASTM D 2103, minimum thickness 5/32 inch. Submit an Integrated Pest Management Plan, including weed and pest management strategies and proposed alternatives to herbicides and pesticides. Use biological pest controls as approved in the Plan.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include mowing, edging, fertilizing, watering, weeding, pruning, and stake and guy adjusting, for all newly installed landscape areas, unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

The Contractor shall police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Collected debris shall be promptly removed and disposed of at an approved disposal site.

3.1.2 Drainage System Maintenance

The Contractor shall remove all obstructions from surface and subsurface drain lines to allow water to flow unrestricted in swales, gutters, and catch basins. Remove grates and clear debris in catch basins. Open drainage channels are to be maintained free of all debris and vegetation at all times. Edges of these channels shall be clear of any encroachment by vegetation.

3.2 IRRIGATION ESTABLISHMENT PERIOD

The irrigation establishment period will commence on the date that inspection by the Contracting Officer's Technical Representative shows that the newly planted exterior plants have been installed per requirements and shall continue for a period of 90 days.

3.2.1 Water Restrictions

The Contractor shall abide by state, local or other water conservation regulations in force during the establishment period.

3.2.2 Fire Hydrants

To use a fire hydrant for irrigation, the Contractor shall obtain prior clearance from the Contracting Officer's Technical Officer and provide the tools and connections approved for use on fire hydrants. If a fire hydrant is used, Contractor shall provide a reduced pressure backflow preventer for each connection between hose and fire hydrant. Backflow preventer used shall be tested once per month by a certified backflow preventer tester.

3.2.3 Final Acceptance

Upon completion of the irrigation establishment period and final acceptance of groundcover and exterior plants, irrigation equipment shall be removed.

3.3 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the Contracting Officer shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period shall continue for a period of 90 days.

3.3.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed. Inspect areas once a week during the installation and establishment period and perform needed maintenance promptly.

3.3.2 Promotion of Growth

Groundcover shall be maintained in a manner that promotes proper health, growth, natural color. Turf shall have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, and overseed and perform other operations necessary to promote growth, as approved by Contracting Officer's Technical Representative and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.3.3 Mowing

3.3.3.1 Turf

Turf shall be mowed at a uniform finished height. Mow turfed area to a minimum average height of 3-4 inches when average height of grass becomes 6 inches for spring/summer maintenance and to a minimum average height of 3-4 inches when the average height of grass reaches 5 inches for fall and winter maintenance. The height of turf is measured from the soil. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area shall be picked up and disposed. Adjacent paved areas shall be swept/vacuumed clean.

3.3.4 Turf Edging and Trimming

Perimeter of planter bed edges, sidewalks, driveways, curbs, and other paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas such as an edge between turfgrass and a planter bed. Care shall be exercised to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf's mowed. Care shall be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas may be utilized as a temporary means to avoid injury to tree trunks. At the end of the plant establishment period Contractor will be responsible for removing all protective tree collars.

3.3.5 Post-Fertilizer Application

Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies shall be determined by the laboratory soil analysis results the requirements of the particular turf species. Organic fertilizer shall be used. In the event that organic fertilizer is not producing the desired effect, the Contractor shall contract the Contracting Officer's Technical Representative for approval prior to the use of a synthetic type of fertilizer. Fertilizer shall be applied by approved methods in accordance with the manufacturer's recommendations.

3.3.6 Turf and Plant Watering

The Contractor shall perform watering in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, State, and local water agencies and authorities directives. Watering shall be performed regulary from planting to the end of the establishment period. The Contractor shall be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. The Contractor shall abide by state, local or other water conservation regulations or restrictions in force during the establishment period.

3.3.7 Turf Clearance Area

Trees located in turf areas shall be maintained with a growth free clearance of 24 inches from the tree trunk base. The use of mechanical weed whips to accomplish the turf growth free bed area is prohibited.

3.3.8 Replanting

Replant in accordance with Section 32 92 19 SEEDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

3.3.9 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf. Final acceptance of grass areas will be based upon a stand of 95 percent groundcover of established species.

3.3.10 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer's Technical Representative.

3.4 EXTERIOR PLANT ESTABLISHMENT PERIOD

The exterior plant establishment period will commence on the date that inspection by the Contracting Officer shows that the new plants furnished under this contract have been satisfactorily installed and shall continue for a period of 90 days.

3.4.1 Frequency of Maintenance

Begin maintenance immediately after plants have been installed. Inspect exterior plants at least biweekly during the installation and establishment period and perform needed maintenance promptly.

3.4.2 Promotion of Plant Growth and Vigor

Water, prune, fertilize, mulch, adjust stakes, guys and turnbuckles, eradicate weeds and perform other operations necessary to promote plant growth, and vigor.

3.4.3 Planter Bed Maintenance

Planter beds shall be weeded, fertilized, irrigated, kept pest free, turf free, pruned, and mulch levels maintained. Planter beds will not be allowed to encroach into turf areas. A definite break shall be maintained between turf areas and planter beds. Fertilize exterior planting materials to promote healthy plant growth without encouraging excessive top foliar growth. Remove noxious weeds common to the area from planting areas by mechanical means.

3.4.3.1 Shrub Selective Maintenance

In addition to the above requirements, shrubs shall be selectively pruned, and shaped for health and safety when the following conditions exist: Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel; Remove dead, damaged or diseased branches or limbs; where shrub growth obstructs pedestrian walkways; where shrub growth is found growing against or over structures; where shrub growth permits concealment of unauthorized persons. All pruning debris shall be disposed of in a proper manner.

3.4.3.2 Tree Maintenance

Tree maintenance shall include adjustment of stakes, ties, guy supports and turnbuckles, watering, fertilizing, pest control, mulching, pruning for health and safety and fall leaf cleanup. Fertilize exterior trees to promote healthy plant growth without encouraging excessive top foliar growth. Stakes, ties, guy supports and turnbuckles shall be inspected and adjusted to avoid girdling and promote natural development. All trees within the project boundaries, regardless of caliper, shall be selectively pruned for safety and health reasons. These include but are not limited to removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced. Pruning of all trees including palm trees shall be accomplished by or in the presence of a certified member of the International Society of Arboriculture and in accordance with ANSI Z133.1. All pruning debris generated shall be disposed of in a proper manner.

3.4.4 Removal of Dying or Dead Plants

Remove dead and dying plants and provide new plants immediately upon commencement of the specified planting season, and replace stakes, guys, mulch and eroded earth mound water basins. No additional plant establishment period will be required for replacement plants beyond the original warranty period. A tree shall be considered dying or dead when the main leader has died back, or a minimum of 20 percent of the crown has died. A shrub or ground cover shall be considered dying or dead when a minimum of 20 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine the cause for dying plant material and shall provide recommendations for replacement. The Contractor shall determine the cause for dying plant material and provide recommendations for replacement.

3.4.5 Tracking of Unhealthy Plants

Note plants not in healthy growing condition, as determined by the Contracting Officer's Technical Representative, and as soon as seasonal conditions permit, remove and replace with plants of the same species and sizes as originally specified. Install replacement plantings in accordance with Section 32 93 00 EXTERIOR PLANTS.

3.4.6 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final inspection will be based upon satisfactory health and growth of plants and on the following:

3.4.6.1 Total Plants on Site

Plants have been accepted and required number of replacements have been installed.

3.4.6.2 Mulching and Weeding

Planter beds and earth mound water basins are properly mulched and free of weeds.

3.4.6.3 Tree Supports

Stakes guys and turnbuckles are in good condition.

3.4.6.4 Remedial Work

Remedial measures directed by the Contracting Officer's Technical Representative to ensure plant material survival and promote healthy growth have been completed.

3.4.7 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer' Technical Representative.

3.5 FIELD QUALITY CONTROL

3.5.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations shall be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Results of site observation visits shall be submitted to the Contracting Officer's Technical Representative within 7 calendar days of each site observation visit.

3.5.2 Plant Quantities

The Contractor shall provide Contracting Officer's Technical Representative with the number of plant quantities. In addition, provide total exterior area of hardscape and landscaping such as turf and total number of shrubs.

3.5.3 Tree Staking and Guying Removal

The Contractor shall remove all stakes and guys from all project trees at the end of the establishment period.

-- End of Section --

SECTION 32 10 00

BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 230	(1968; R 2000) Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures
AASHTO T 30	(2007) Mechanical Analysis of Extracted Aggregate

ASTM INTERNATIONAL (ASTM)

ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2172	(2005) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2005) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

STATE OF GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT	(2001) Standard Specifications, Construction of Roads and Bridges

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Local/Regional Materials; (LEED)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-06 Test Reports

Trial batch reports;

Mix design;

Asphalt concrete;

Density;

Thickness;

Straightedge test;

Submit reports for testing specified under paragraph entitled "Field Quality Control."

SD-07 Certificates

Asphalt concrete;

Submit certificates, signed by the producer, that paving materials and incidental construction items conform to specification requirements.

1.3 QUALITY ASSURANCE

1.3.1 Regulatory Requirements

Provide work and materials in accordance with applicable requirements of GDOT. Sections and Paragraphs 400 and 828 mentioned herein refer to those specifications. Paragraphs in GDOT entitled "Measurement" and "Payment" shall not apply.

1.3.2 Modification of References

Where term "Engineer" is used in GDOT it shall be construed to mean Contracting Officer's Technical Representative. Where term "state" is used, it shall mean "Federal Government".

1.3.3 Trial Batch

Submit current bituminous design reports for all mix types proposed for use on the project.

1.3.4 Mix Design

Submit results of laboratory tests performed on each mix design. Testing shall have been accomplished not more than one year prior to date of material placement.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not produce or place bituminous concrete when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.

1.5 SUSTAINABLE DESIGN REQUIREMENTS

1.5.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE

Provide asphalt concrete in accordance with the applicable requirements of the GDOT, except where specified otherwise. Recycled asphalt pavement material may be used as permitted by GDOT.

2.2 BASE COURSE

GDOT, materials for construction of the base course shall be in accordance with Section 815.2.02.

2.3 SURFACE COURSE

GDOT, materials for construction of the surface course shall be in accordance with Section 828.2.02Type 9.5 mm SMA.

2.4 STRIPING

GDOT, materials for paint striping shall be in accordance with Section 652 and Section 870.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Excavation and Filling

Excavation and filling to establish elevation of subgrade is specified in Section 31 00 00 EARTHWORK.

3.2 CONSTRUCTION

Provide construction in accordance with the applicable requirements of the GDOT, except where indicated or specified otherwise.

3.2.1 Subgrade

Preparation of subgrade shall be in accordance with Section 31 00 00 EARTHWORK. Verify compacted subgrade, granular base, or stabilized soil is acceptable and ready to support paving and imposed loads.

3.2.2 Base Course

GDOT, methods of construction of the base course shall be in accordance with Section 310.

3.2.3 Surface Course

GDOT, methods of construction of the surface course shall be in accordance with Section 400. Placement will not be permitted unless the Contractor has a working asphalt thermometer on site.

3.2.4 Striping

GDOT, provide paint striping in accordance with Section 870. Allow bituminous pavement to cure for at least 21 days before paint is applied. Pavement shall be thoroughly clean and entirely free of loose sand, stones, dust, oil, grease, water, and other substances that will be deleterious to the paint or will adversely affect the adhesion of the paint. Do not apply paint during high wind (over 15 miles per hour) or high humidity (over 70 percent). Apply paint only when ambient temperature is 40 degrees F or above and rising but not more than 95 degrees F. Dimensions and arrangement of striping shall be as indicated. Apply paint to a wet film thickness of 0.015 inch by means of conventional traffic line striping equipment. Traffic shall not be permitted to use the painted areas for a minimum of 30 minutes after painting of lines has been completed.

3.3 FIELD QUALITY CONTROL

Sample shall be taken by Contractor as specified herein. Contractor shall replace pavement where sample cores have been removed. Submit 2 pavement cores when using the in-place nuclear density method.

3.3.1 Testing

3.3.1.1 Bituminous Mix Testing

Take two samples per day per mix type at plant or from truck. Test uncompacted mix for extraction in accordance with ASTM D 2172 and sieve analysis in accordance with AASHTO T 30. Test samples for stability and flow in accordance with ASTM D 1559. When two consecutive tests fail to meet requirements of specifications, cease placement operations and test a new trial batch prior to resumption of placement operations. Submit 2 per day of each mix type. When two tests on uncompacted mix fail submit new trial batch for approval.

3.3.1.2 Testing of Pavement Course

a. Density: Determine density of pavement by testing cores obtained from the surface course in accordance with AASHTO T 230. Take three cores at location designated by Contracting Officer's Technical Representative for each 200 tons, or fraction thereof, of asphalt placed. Deliver cores undisturbed and undamaged to laboratory and provide test results within 48 hours of each day placement of paving materials.

b. Thickness: Determine thickness of the surface course from cores taken for density test.

c. Straightedge Test: Test compacted surface course with a straightedge as work progresses. Apply straightedge parallel with and at right angles to center line after final rolling. Variations in surface course surface shall not be more than 1/4 from the lower edge of the 10 foot straightedge.

d. Noncompliant pavement shall be replaced or corrected as directed by the Contracting Officer's Technical Representative at no additional expense to the Government.

3.4 WASTE MANAGEMENT

Protect excess material from contamination and return to manufacturer, or reuse on-site for walkways, patching, ditch beds, speed bumps, or curbs.

-- End of Section --

SECTION 32 16 13

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(2005) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

ASTM INTERNATIONAL (ASTM)

ASTM A 185/A 185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 615/A 615M	(2007) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2005a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 171	(2003) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(2007) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 309	(2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2006) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1751	(2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

ASTM D 5893	(2004) Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete;

Copies of certified delivery tickets for all concrete used in the construction.

SD-06 Test Reports

Field Quality Control;

Copies of all test reports within 24 hours of completion of the test.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F.Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F at any time.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer's Technical Representative shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.1.1 Slump

The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143/C 143M.

2.1.2 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615/A 615M. Wire mesh reinforcement shall conform to ASTM A 185/A 185M.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

Joint sealant, cold-applied shall conform to ASTM C 920 or ASTM D 5893.

2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted as directed.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends

shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of 1/4 inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.

3.4.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.4.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D 1752 or building paper. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant. Joint sealant shall be gray or stone in color. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.4.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.5 CURING AND PROTECTION

3.5.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be

on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.5.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.5.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.5.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet/gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing

compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.5.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.5.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.6 FIELD QUALITY CONTROL

3.6.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.6.2 Concrete Testing

3.6.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.6.2.2 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.6.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section.

3.6.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.7 SURFACE DEFICIENCIES AND CORRECTIONS

3.7.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.7.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.7.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

3.7.4 Corrections

Noncompliant concrete shall be removed and replaced or corrected as directed by the Contracting Officer's Technical Representative at no additional expense to the Government.

-- End of Section --

SECTION 32 17 24.00 10

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952	(Rev E) Paint, Traffic and Airfield Markings, Waterborne

1.2 SYSTEM DESCRIPTION

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Submit lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.2.1 Paint Application Equipment

1.2.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified.Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.2.1.2 Hand-Operated, Push-Type Machines

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.2.2 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.2.3 Surface Preparation Equipment

1.2.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.2.3.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

1.2.4 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.2.4.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.2.4.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradable residue.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing

1.4 QUALITY ASSURANCE

1.4.1 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.4.2 Maintenance of Traffic

1.4.2.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.5 DELIVERY, STORAGE, AND HANDLING

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.6 ENVIRONMENTAL REQUIREMENTS

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, parking areas, and streets shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Submit certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers in the presence of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Thoroughly clean surfaces to be marked before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Remove existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.2 Cleaning Concrete Curing Compounds

On new portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified. Provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

a. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet/gallon.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Raised Reflective Markers

Prefabricated markers shall be aligned carefully at the required spacing and permanently fixed in place by means of epoxy resin adhesives. To insure good bond, pavement in areas where markers will be set shall be thoroughly cleaned by sandblasting and use of compressed air prior to applying adhesive.

3.2.3 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the

specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

3.3 MARKING REMOVAL

Pavement marking, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

-- End of Section --

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 602	(2007) Agricultural Liming Materials
ASTM D 4427	(2007) Peat Samples by Laboratory Testing
ASTM D 4972	(2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch;

Fertilizer;

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Sulfur, Iron and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer sulphur, iron and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer, Sulfur, Iron and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer's Technical Representative.

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	Feb 15 - June 30
Season 2	Nov 1 - Jan 31
Temporary Seeding 1	Aug 15 - Mar 31
Temporary Seeding 2	Apr 1 - July 15

2.1.3 Seed Purity

Botanical Name	Common Name	Min. Percent Pure Seed
Cynodon Daclylon	Common Bermuda (Hulled or Unhulled)	100%
Lolium Mutliflorum	Annual Ryegrass	100%
Secale Cereale	Rye	100%
Panicum Fasciculalum	Browntop Millet	100%

2.1.4 Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
Season 1	Common Bermuda (Hulled)	100%
Season 2	Common Bermuda (Unhulled)	60%
	Rye	40%
Temporary Seeding 1	Annual Ryegrass	100%
Temporary Seeding 2	Browntop Millet	100%

Proportion seed mixtures by weight. Temporary seeding must later be replaced by Season 1 or Season 2 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 or Season 2 apply for temporary seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade hydrate or burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 110 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

20 percent available nitrogen
10 percent available phosphorus
10 percent available potassium

2.4.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the following minimum percentages, by weight, of plant food nutrients.

20 percent available nitrogen
10 percent available phosphorus
10 percent available potassium

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.5.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.6 WATER

Source of water shall be approved by Contracting Officer's Technical Representative and of suitable quality for irrigation, containing no elements toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of off-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters or soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer's Technical Representative. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer's Technical Representative stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be broadcasted and drop seeding or hydroseeding.

3.2.2.1 Broadcast and Drop Seeding

Seed shall be uniformly broadcast at the rate of 1500pounds per acre. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.2.2 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of 1500pounds per acre. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.2.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.2.3.3 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer's Technical Representative.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RENOVATION OF EXISTING TURF AREA

3.4.1 Overseeding

Apply seed in accordance with applicable portions of paragraph entitled "Seed Application Method" at rates in accordance with paragraph entitled "Seed Composition."

3.5 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 32 93 00

EXTERIOR PLANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance
ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush
ANSI Z60.1	(1996) Nursery Stock

ASTM INTERNATIONAL (ASTM)

ASTM A 580/A 580M	(2006) Standard Specification for Stainless Steel Wire
ASTM D 4972	(2001; R 2007) pH of Soils
ASTM D 5852	(2000; R 2007) Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
ASTM D 6629	(2001; R 2007) Selection of Methods for Estimating Soil Loss by Erosion

L.H. BAILEY HORTORIUM (LHBH)

LHBH	(1976) Hortus Third

1.2 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, Section 32 92 23 SEEDING, and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Organic Mulch Materials

Mulch;

Fertilizer;

Weed control fabric;

Staking Material
Ground Stakes;

Metal anchors;

SD-06 Test Reports

Topsoil composition tests;

SD-07 Certificates

Nursery certifications;

Indicate names of plants in accordance with the LHBH, including type, quality, and size.

1.4 QUALITY ASSURANCE

1.4.1 Topsoil Composition Tests

Commercial test from an independent testing laboratory including basic soil groups (moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D 4972), soil salinity), secondary nutrient groups (calcium, magnesium, sodium, Sodium Absorption Ratio (SAR)), micronutrients (zinc, manganese, iron, copper), toxic soil elements (boron, chloride, sulfate), cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being transplanted. Soil required for each test shall include a maximum depth of 18 inches of approximately 1 quart volume for each test. Areas sampled should not be larger than 1 acre and should contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.

1.4.2 Nursery Certifications

a. Indicate on nursery letterhead the name of plants in accordance with the LHBH, including botanical common names, quality, and size.

b. Inspection certificate.

c. Mycorrhizal fungi inoculum for plant material treated

1.4.3 State Landscape Contractor's License

Construction company shall hold a landscape contractors license in the state of Georgia and have a minimum of five years landscape construction experience. Submit copy of license and three references for similar work completed in the last five years.

1.4.4 Not used

1.4.5 Not used

1.4.6 Not used

1.4.7 Pre-Installation Meeting

Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this section. Review conditions of operations, procedures and coordination with related work. Agenda shall include the following:

a. Tour, inspect, and discuss conditions of planting materials.

b. Review planting schedule and maintenance.

c. Review required inspections.

d. Review environmental procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Branched Plant Delivery

Deliver with branches tied and exposed branches covered with material which allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.

1.5.1.2 Soil Amendment Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulfur, iron, and lime may be furnished in bulk with a certificate indicating the above information. Store in dry locations away from contaminates.

1.5.1.3 Plant Labels

Deliver plants with durable waterproof labels in weather-resistant ink. Provide labels stating the correct botanical and common plant name and variety as applicable and size as specified in the list of required plants. Attach to plants, bundles, and containers of plants. Groups of plants may be labeled by tagging one plant. Labels shall be legible for a minimum of 60 days after delivery to the planting site.

1.5.2 Storage

1.5.2.1 Plant Storage and Protection

Store and protect plants not planted on the day of arrival at the site as follows:

a. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted.

b. Heel-in bare root plants.

c. Protect balled and burlapped plants from freezing or drying out by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.

d. Keep plants in a moist condition until planted by watering with a fine mist spray.

e. Do not store plant material directly on concrete or bituminous surfaces.

1.5.2.2 Fertilizer, Gypsum, pH Adjusters and Mulch Storage

Store in dry locations away from contaminants.

1.5.2.3 Topsoil

Prior to stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.4 Weed Control Fabric

Store materials on site in enclosures or under protective covering in dry location. Store under cover out of direct sunlight. Do not store materials directly on ground.

1.5.3 Handling

Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped bare root, balled and potted, processed balled and/or in-ground fabric bag grown plants carefully to avoid damaging or breaking the earth ball or root structure. Do not handle plants by the trunk or stem. Remove damaged plants from the site.

1.5.4 TIME LIMITATION

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum of 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum of 24 hours.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.

1.6.1 Planting Dates

1.6.1.1 Deciduous Material

Deciduous material from 3/1 to 5/15 for spring planting and from 10/1 to 11/30 for fall planting.

1.6.1.2 Evergreen Material

Evergreen material from 3/1 to 4/30 for spring planting and from 9/1 to 9/30 for fall planting.

1.6.2 Restrictions

Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit

1.7 GUARANTEE

All plants shall be guaranteed for one year beginning on the date of inspection by the Contracting Officer's Technical Representative to commence the plant establishment period, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Government or by weather conditions unusual for the warranty period.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Regulations and Varieties

Existing trees and shrubs to remain shall be protected and a planting plan be arranged around them.Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Each plant or group of planting shall have a "key" number indicated on the nursery certifications of the plant schedule. Furnish plants, including turf grass, grown under climatic conditions similar to those in the locality of the project. Plants specified shall be low maintenance varieties, tolerant of site's existing soils and climate. Spray plants budding into leaf or having soft growth with an antidesiccant before digging. Plants of the same specified size shall be of uniform size and character of growth. Plants shall be chosen with their mature size and growth habit in mind to avoid over-planting and conflict with other plants, structures or underground utility lines. All plants shall comply with all Federal and State Laws requiring inspection for plant diseases and infestation.

2.1.2 Shape and Condition

Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having a healthy, normal, and undamaged root system.

2.1.2.1 Deciduous Trees and Shrubs

Symmetrically developed and of uniform habit of growth, with straight boles or stems, and free from objectionable disfigurements.

2.1.2.2 Evergreen Trees and Shrubs

Well developed symmetrical tops with typical spread of branches for each particular species or variety.

2.1.3 Plant Size

Minimum sizes measured after pruning and with branches in normal position, shall conform to measurements indicated, based on the average width or height of the plant for the species as specified in ANSI Z60.1. Plants larger in size than specified may be provided with approval of the Contracting Officer's Technical Representative. When larger plants are provided, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.

2.1.4 Root Ball Size

All box-grown, field potted, field boxed, collected, plantation grown, bare root, balled and burlapped, container grown, processed-balled, and in-ground fabric bag-grown root balls shall conform to ANSI Z60.1. All wrappings and ties shall be biodegradable. Root growth in container grown plants shall be sufficient to hold earth intact when removed from containers. Root bound plants will not be accepted.

2.1.4.1 Mycorrhizal fungi inoculum

Before shipment, root systems shall contain mycorrhizal fungi inoculum.

2.1.5 Growth of Trunk and Crown

2.1.5.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANSI Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.

2.1.5.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANSI Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.5.3 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANSI Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

2.2 TOPSOIL

2.2.1 Existing Soil

Modify to conform to requirements specified in paragraph entitled "Composition" of specification Section 32 92 19, SEEDING.

2.3 SOIL CONDITIONERS

Provide as found in paragraph entitled "Soil Conditioners", Section 32 92 19, SEEDING.

2.4 PLANTING SOIL MIXTURES

100 percent topsoil as specified in Section 32 92 19, SEEDING.

2.5 FERTILIZER

Fertilizer for grasses is not permitted.
Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.5.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus
8 percent available potassium

2.5.2 Fertilizer Tablets

Organic, plant tablets composed of tightly compressed fertilizer chips forming a tablet that is insoluble in water, is designed to provide a continuous release of nutrients for at least 24 months and contains the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus
8 percent available potassium

2.6 WEED CONTROL FABRIC

2.6.1 Roll Type Polypropylene or Polyester Mats

Fabric shall be woven, needle punched or non-woven and treated for protection against deterioration due to ultraviolet radiation. Fabric shall be minimum 99 percent opaque to prevent photosynthesis and seed germination from occurring, yet allowing air, water and nutrients to pass thru to the

roots. Minimum weight shall be 5 ounces per square yard with a minimum thickness of 20 mils with a 20 year (minimum) guarantee.

2.7 MULCH

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.7.1 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark or shredded hardwood from site when available. Biobased content shall be a minimum of 100 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application. Paper-based hydraulic mulch shall contain a minimum of 100 percent post-consumer recycled content. Wood-based hydraulic mulch shall contain a minimum of 100 percent recycled material.

2.8 STAKING AND GUYING MATERIAL

2.8.1 Staking Material

2.8.1.1 Tree Support Stakes

Rough sawn hard wood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Stakes shall be minimum 2 inches square or 2 1/2 inch diameter by 8 feet long, pointed at one end.

2.8.1.2 Ground Stakes

100 percent post-consumer recycled content plastic, 2 inches square are by 3 feet long, pointed at one end.

2.8.2 Guying Material

2.8.2.1 Guying Wire

12 gauge annealed galvanized steel, ASTM A 580/A 580M.

2.8.2.2 Guying Cable

Minimum five-strand, 3/16 inch diameter galvanized steel cable.

2.8.3 Hose Chafing Guards

New or used 2 ply 3/4 inch diameter reinforced rubber or plastic hose, black or dark green, all of same color.

2.8.4 Flags

White surveyor's plastic tape, 12 inches long, fastened to guying wires or cables.

2.8.5 Turnbuckles

Galvanized or cadmium-plated steel with minimum 3 inch long openings fitted with screw eyes. Eye bolts shall be galvanized or cadmium-plated steel with one inch diameter eyes and screw length 1 1/2 inches, minimum.

2.8.6 Metal Anchors

2.8.6.1 Driven Anchors

Malleable iron, arrow shaped, galvanized, sized as follows:

Tree Caliper	Anchor Size
2 inches and under	3 inches
3 to 6 inches	4 inches
6 to 8 inches	6 inches
8 to 10 inches	8 inches
10 to 12 inches	10 inches

2.8.6.2 Screw Anchors

Steel, screw type with welded-on 3 inch round helical steel plate, minimum 3/8 inch diameter, 15 inches long.

2.9 NOT USED

2.10 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.10.1 Erosion Control Blanket

100 percent agricultural straw stitched with a degradable nettings, designed to degrade within 18 months.

2.10.2 Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.10.3 Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inch square.

2.10.4 Not used

2.10.5 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

2.11 WATER

Source of water to be approved by Contracting Officer's Technical Representative and suitable quality for irrigation and shall not contain elements toxic to plant life, including acids, alkalis, salts, chemical

pollutants, and organic matter. Use collected storm water or graywater when available.

2.12 NOT USED

2.13 SOURCE QUALITY CONTROL

The Contracting Officer's Technical Representative will inspect plant materials at the project site and approve them. Tag plant materials for size and quality.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide soil preparation, fertilizing, tree, shrub, and planting, staking and guying, weed control fabric,, erosion control material and installation and a mulch topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 PREPARATION

3.2.1 Protection

Protect existing and proposed landscape features, elements, and sites from damage or contamination. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than the drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.

3.2.2 Layout

Stake out approved plant material locations and planter bed outlines on the project site before digging plant pits or beds. The Contracting Officer's Technical Representative reserves the right to adjust plant material locations to meet field conditions. Do not plant closer than 36 inches to a building wall, pavement edge, fence or wall edge and other similar structures.

3.2.3 Erosion Control

Provide erosion control and seeding with native plant species to protect slopes.

3.2.4 Soil Preparation

3.2.4.1 pH Adjuster Application Rates

Apply pH adjuster at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.4.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.4.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.3 PLANT BED PREPARATION

Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Depth of plant pit excavation shall be as indicated and provide proper relation between top of root ball and finished grade. Install plant material as specified in paragraph entitled "Plant Installation." Do not install trees within 10 feet of any building walls.

3.4 PLANT INSTALLATION

3.4.1 Individual Plant Pit Excavation

Excavate pits at least twice as large in diameter as the size of ball or container to depth shown.

3.4.2 Plant Beds with Multiple Plants

Excavate plant beds continuously throughout entire bed as outlined to depth shown.

3.4.3 Handling and Setting

Move plant materials only by supporting the root ball. Set plants on hand compacted layer of prepared backfill soil mixture 6 inches thick and hold plumb in the center of the pit until soil has been tamped firmly around root ball. Set plant materials, in relation to surrounding finish grade, level to the depth at which they were grown in the nursery, collecting field or container. Replace plant material whose root balls are cracked or damaged either before or during the planting process.

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas.

3.4.3.1 Balled and Burlapped Stock

Backfill with prepared soil mixture and topsoil to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials from the top a minimum 1/3 depth from the top of the rootball. Tamp and complete backfill, place mulch topdressing, and water. Remove wires and non-biodegradable materials from plant pit prior to backfill operations.

3.4.3.2 Bare-Root Stock

Plant so roots are arranged in a natural position. Place roots in water a minimum of 30 minutes prior to planting. Carefully work prepared soil mixture and topsoil among roots. Tamp remainder of backfill, place mulch topdressing and water.

3.4.3.3 Container Grown Stock

Remove from container and prevent damage to plant or root system.

3.4.4 Earth Mounded Watering Basin for Individual Plant Pits

Form with topsoil around each plant by replacing a mound of topsoil around the edge of each plant pit. Watering basins shall be 6 inches deep for trees and 4 inches deep for shrubs. Eliminate basins around plants in plant beds containing multiple plants.

3.4.5 Weed Control Fabric Installation

Remove grass and weed vegetation, including roots, from within the area enclosed by edging. Completely cover areas enclosed by edging with specified weed control fabric prior to placing mulch layer. Overlap cut edges 6 inches.

3.4.6 Erosion Control Material

Install in accordance with manufacturer's instructions.

3.4.7 Placement of Mulch Topdressing

Place specified mulch topdressing on top of weed control fabric covering total area enclosed by edging. Place mulch topdressing to a depth of 3 inches.

3.4.8 Mulch Topdressing

Provide mulch topdressing over entire planter bed surfaces and individual plant surfaces including earth mound watering basin around plants to a depth of 3 inches after completion of plant installation and before watering. Keep mulch out of the crowns of shrubs. Place mulch a minimum 6 inches away from trunk of shrub or tree. Place on top of any weed control fabric.

3.4.9 Fertilization

3.4.9.1 Fertilizer Tablets

Place fertilizer planting tablets evenly spaced around the plant pits to the manufacturer's recommended depth.

3.4.9.2 Granular Fertilizer

Apply granular fertilizer as a top coat prior to placing mulch layer and water thoroughly.

3.4.10 Watering

Start watering areas planted as required by temperature and wind conditions. Slow deep watering shall be used. Apply water at a rate sufficient to

ensure thorough wetting of soil to a depth of 12 inches without run off or puddling. Watering of other plant material or adjacent areas shall be prevented.

3.4.11 Staking and Guying

3.4.11.1 Staking

Stake plants with the number of stakes indicated complete with double strand of 12 gage guy wire as detailed. Attach guy wire half the tree height but not more than 5 feet high. Drive stakes to a depth of 2 1/2 to 3 feet into the ground outside the plant pit. Do not injure the root ball. Use hose chafer guards where guy wire comes in contact with tree trunk.

3.4.11.2 Guying

Guy plants as indicated.

3.4.11.3 Chafing Guards

Use hose chafing guards, as specified where guy wire cable will contact the plant.

3.4.11.4 Deadmen

Place deadmen minimum 18 inches below ground surface. Place equal distance from tree trunk and around the plant pit.

3.4.11.5 Wood Ground Stakes

Drive wood ground stakes into firm ground outside of plant pit with top of stake flush with ground. Place equal distance from tree trunk and around the plant pit.

3.4.11.6 Iron Anchors

Drive malleable iron anchors into firm ground outside of plant pit a minimum 30 inches below finish grade. Place equal distance from tree trunk and around the plant pit.

3.4.11.7 Steel Screw Anchors

Insert steel screw anchors as recommended in manufacturer's data. Place equal distance from tree trunk and around the plant pit.

3.4.11.8 Flags

Securely fasten flags on each guy wire and cable approximately two-thirds of the distance up from ground level.

3.4.12 Pruning

Prune in accordance with safety requirement of ANSI Z133.1.

3.4.12.1 Trees and Shrubs

Remove dead and broken branches. Prune to correct structural defects only. Retain typical growth shape of individual plants with as much height and spread as practical.Do not cut central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars shall remain in place. Pruning shall be accomplished by trained and experienced personnel and shall be accordance with ANSI A300.

3.4.12.2 Wound Dressing

Do not apply tree wound dressing to cuts.

3.5 RESTORATION AND CLEAN UP

3.5.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.5.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite at an approved landfill, recycling center, or composting center. Adjacent paved areas shall be cleared.

-- End of Section --

SECTION 33 11 00

WATER DISTRIBUTION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2004) Hypochlorites
AWWA B301	(2004) Liquid Chlorine
AWWA C104/A21.4	(2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2003) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153/A21.53	(2006) Ductile-Iron Compact Fittings for Water Service
AWWA C500	(2002; R 2003) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(2005) Dry-Barrel Fire Hydrants
AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C800	(2005) Underground Service Line Valves and Fittings
AWWA C900	(2007) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASME B16.26	(2006) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

ASTM INTERNATIONAL (ASTM)

ASTM B 61	(2002) Standard Specification for Steam or Valve Bronze Castings
ASTM B 62	(2002) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(2004e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2774	(2004e1) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 402	(2005) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 325	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 49	(2003) Hazardous Chemicals Data
NFPA 704	(2006) Identification of the Hazards of Materials for Emergency Response

UNDERWRITERS LABORATORIES (UL)

UL 246	(1993; Rev thru Dec 1998) Hydrants for Fire-Protection Service
UL 262	(2004) Standard for Gate Valves for Fire-Protection Service

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)

1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 6 inch lines of ductile-iron or polyvinyl chloride (PVC) plastic pipe. Provide water main accessories, gate valves as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines indicated as 2-1/2 inch lines from water distribution main to building service at the point indicated. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances as specified and where indicated.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping Materials;

Water distribution main piping, fittings, joints, valves, and coupling;

Hydrants;

Valve boxes;

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

SD-06 Test Reports

Bacteriological Disinfection; G

Test results from commercial laboratory verifying disinfection

SD-07 Certificates

Fire hydrants;

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.4.2.1 Miscellaneous Plastic Pipe and Fittings

Handle Polyvinyl Chloride (PVC), pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Ductile-Iron Piping

a. Pipe and Fittings: Pipe, AWWA C151/A21.51, Pressure Class 150. Fittings, AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104/A21.4, standard thickness.

b. Joints and Jointing Material:

(1) Joints: Joints for pipe and fittings shall be push-on joints or mechanical joints.

(2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111/A21.11.

(3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111/A21.11.

2.1.1.2 Polyvinyl Chloride (PVC) Plastic Piping

a. Pipe and Fittings: Pipe, AWWA C900, shall be plain end or gasket bell end, Pressure Class 150 (DR 18) with cast-iron-pipe-equivalent OD.

b. Fittings for PVC pipe: Fittings shall be gray iron or ductile iron, AWWA C110/A21.10 or AWWA C153/A21.53, and have cement-mortar lining, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe specified in this paragraph. Iron fittings and specials shall be cement-mortar lined in accordance with AWWA C104/A21.4.

c. Joints and Jointing Material: Joints for pipe shall be push-on joints, ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints ASTM D 3139, or compression-type joints/mechanical joints, ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe, ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints.

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, (2) AWWA C509 shall be nonrising stem type with mechanical-joint ends or resilient-seated gate valves 3 to 12 inches in size, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have 0-ring stem seals.Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.

2.1.2.2 Fire Hydrants

Dry-barrel type. Paint hydrants with at least one coat of primer and two coats of red enamel paint.

a. Dry-Barrel Type Fire Hydrants: Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, shall have 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Inlet shall have mechanical-joint or push-on joint end; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap

nuts, and threads on hose and pumper connections shall be as specified in AWWA C502. Hydrants indicated as "traffic type," shall have frangible sections as mentioned in AWWA C502. The traffic type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and upper and lower sections of hydrant stem and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall operate properly under normal conditions.

2.1.2.3 Valve Boxes

Provide a valve box for each gate valve. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Cast-iron boxes shall have a minimum cover and wall thickness of 3/16 inch. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.4 Tracer Wire for Nonmetallic Piping

Provide as specified in Section 31 00 00, EARTHWORK.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation (NSF) for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer.

a. Polyvinyl Chloride (PVC) Plastic Piping with Screw Joints: ASTM D 1785, Schedule 40; or ASTM D 2241, with SDR as necessary to provide 150 psi minimum pressure rating. Fittings, ASTM D 2466 or ASTM D 2467. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12; PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing, ASTM D 2564. Pipe couplings, when used shall be tested as required by ASTM D 2464.

b. Polyvinyl Chloride (PVC) Plastic Piping with Elastomeric-Gasket Joints:

   Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified.

c. Polyvinyl Chloride (PVC) Plastic Piping with Solvent Cement Joints:

   Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

2.2.2.2 Service Clamps

Service clamps used for repairing damaged cast-iron, steel, PVC or asbestos-cement pipe shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.2.2.3 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

2.2.2.4 Gate Valves Smaller than 3 Inch in Size

Gate valves smaller than 3 inch size MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.

2.2.2.5 Curb Boxes

Provide a curb box for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

2.2.2.6 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.2.2.7 Meters

Contractor shall supply and install in accordance with the Brunswick-Glynn Joint Water and Sewer Commission.

2.2.2.8 Meter Boxes

Contractor shall supply and install in accordance with the Brunswick-Glynn Joint Water and Sewer Commission.

2.2.2.9 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sewer line. Do not lay water lines in the same trench with electric wiring.

Where water piping is required to be installed within 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casting Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00.

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings.Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted.Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate

recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 feet.

3.1.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.1.5 Connections to Existing Water Lines

All connections to potable water lines 12 inches in diameter and smaller using corporation stops or tapping sleeves and tapping valves shall only be made by Brunswick-Glynn Joint Water and Sewer Commission approved Contractors. Coordinate this work, via the Contracting Officer's Technical Representative, with Brunswick-Glynn Joint Water and Sewer Commission Personnel. Provide corporation stops, tapping sleeves and tapping valves, and all other material, labor, and equipment necessary for the connection. Perform all earthwork and disinfection work at the connection prior to installation of the tapping machine by the Government. Perform the disinfection work in the presence of the Brunswick-Glynn Joint Water and Sewer Commission and FLETC personnel. Make connections to existing water lines in the presence of the Brunswick-Glynn Joint Water and Sewer Commission and FLETC personnel.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.

b. Allowable Deflection: The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size

and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94/C 94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.2 Installation of PVC Plastic Water Main Pipe

Installation of PVC Plastic Water Main Pipe and Associated Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines"; with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

b. Offset: Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer's Technical Representative, but shall not exceed 5 degrees.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of UBPPA UNI-B-3 for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94/C 94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts

sand, and 5 parts gravel, having the same minimum compressive strength.

d. Fittings: Install in accordance with AWWA C605.

3.1.2.3 Installation of Valves and Hydrants

a. Installation of Valves: Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, contact the Contracting Officer's Technical Representative for further instructions.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the point indicated; such water service lines shall be closed with plugs or caps.

3.1.4 Special Requirements for Installation of Water Service Piping

3.1.4.1 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

b. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4.2 Location of Meters

Meters and meter boxes shall be installed at the locations shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

3.1.5 Disinfection

Prior to disinfection, obtain Contracting Officer's Technical Representative approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer's Technical Representative approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer's Technical Representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water mains in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test PVC plastic water mains in accordance with the requirements of UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in UBPPA UNI-B-3, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of

the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 33 30 00

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASTM INTERNATIONAL (ASTM)

ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 270	(2007) Standard Specification for Mortar for Unit Masonry
ASTM C 443	(2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 923	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM C 969	(2002) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 972	(2000; R 2006) Compression-Recovery of Tape Sealant
ASTM C 990	(2006) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM D 1784	(2006a) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	(2005) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(2006) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a; R 2003e1) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 4101	(2007) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D 412	(2006a) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 624	(2000e1) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(Basic) Frames.Covers, Gratings, Steps, Sump and Catch Basin, Manhole

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27 Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6 (1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide lateral of polyvinyl chloride (PVC) plastic pipe. Provide building connections polyvinyl chloride (PVC) plastic pipe. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

1.2.2 Sanitary Sewer Pressure Lines

Provide pressure lines of polyvinyl chloride (PVC) plastic pressure pipe.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contracting Officer's Technical Representative. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer's Technical Representative. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipeline materials;

Submit manufacturer's standard drawings or catalog cuts.

SD-06 Test Reports

Reports;

Test and inspection reports, as specified.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

2.1.2.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.

(1) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478 base and first riser shall be monolithic.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923 or ASTM C 990.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Proplene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and values are listed in the following tables:

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic

Tensile, psi	ASTM D 412	1840	2195	-
Elogation percent	ASTM D 412	553	295	350
Tear Resistance, ppi	ASTM D 624 (Die B)	280	160	-
Rebound, percent, 5 minutes	ASTM C 972 (mod.)	-	-	11
Rebound, percent, 2 hours	ASTM C 972	-	-	12

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be as indicated:

Frames and covers shall be cast iron or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 Manhole Steps

Zinc-coated steel as indicated conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less 4 feet deep.

2.4 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 31 00 00 EARTHWORK.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 2 feet below bottom of water line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on

each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

a. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer's Technical Representative before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.2.2 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Pipe Less Than 4 Inch Diameter:

1 Solvent-weld joints shall comply with the manufacturer's instructions.

b. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94/C 94M having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Manhole Construction

Use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. At the existing sewer manhole, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.5.2 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles.

Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.6 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer's Technical Representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in

accordance with ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969.

b. Low-pressure air tests: Perform tests as follows:

1 PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Test PVC plastic pressure lines in accordance with the requirements of AWWA C605 for pressure and leakage tests, using the allowable leakage given therein.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 48/A 48M	(2003) Standard Specification for Gray Iron Castings
ASTM A 536	(1984; R 2004) Standard Specification for Ductile Iron Castings
ASTM B 26/B 26M	(2005) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C 231	(2004) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(2007a) Standard Specification for Mortar for Unit Masonry
ASTM C 443	(2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 76	(2007) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 923	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using

	Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 1751	(2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 6938	(2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipeline materials;

Submit manufacturer's standard drawings or catalog cuts.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76, Class III.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 3500 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.2.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.2.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure.

2.2.4 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48/A 48M, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26/B 26M, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3 MANHOLE STEPS

Zinc-coated steel as indicated conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or

minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less 4 feet deep.

2.4 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C 923.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PIPELINE MATERIALS

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5
Concrete-Lined Corrugated Steel	3
Ductile Iron Culvert	3
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be thoroughly cleaned with a wet brush and the lower portion of the bell filled with mortar as required to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in lengths that extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 8 inches apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

b. Grout: Grout shall be poured between band and pipe from the high side of band only, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be forced out by pouring, and removed.

c. Remainder of Joint: The remaining unfilled upper portion of the joint shall be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete or precast reinforced concrete complete with frames and covers or gratings; and with fixed steps where indicated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe.The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers.This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract

will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 6 inches.

3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.6.5 Determination of Density

Testing is the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained.Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 6938. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 6938 results in a wet unit weight of soil and ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.7 FIELD PAINTING

After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint Do not paint surfaces subject to abrasion.

-- End of Section --

SECTION 33 71 02.00 20

UNDERGROUND ELECTRICAL DISTRIBUTION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318M	(2005) Metric Building Code Requirements for Structural Concrete and Commentary
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005) Standard Specifications for Highway Bridges
AASHTO M 198	(2005) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM INTERNATIONAL (ASTM)

ASTM B 1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B 3	(2001; R 2007) Standard Specification for Soft or Annealed Copper Wire
ASTM B 8	(2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections

ASTM C 857	(2007) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM F 512	(2006) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; Errata 2007) National Electrical Safety Code
IEEE Std 100	(2000) The Authoritave Dictionary of IEEE Standards Terms

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2003) Acceptance Testing Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C119.1	(2006) Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA RN 1	(2005) Standard for Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
NEMA TC 6 & 8	(2003) Standard for Polyvinyl Chloride PVC Plastic Utilities Duct for Underground Installations
NEMA TC 9	(2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007) National Electrical Code - 2008 Edition

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758-A	(2004) Customer-Owned Outside Plant Telecommunications Cabling Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2006; Rev thru Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 44	(2005; Rev thru Nov 2005) Thermoset-Insulated Wires and Cables
UL 467	(2007) Standard for Grounding and Bonding Equipment
UL 486A-486B	(2003; Rev thru Aug 2006) Standard for Wire Connectors
UL 510	(2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(2004; Rev thru Aug 2007) Standard for Metallic Outlet Boxes
UL 514B	(2004; Rev thru Aug 2007) Standard for Conduit, Tubing and Cable Fittings
UL 6	(2007) Standard for Electrical Rigid Metal Conduit-Steel
UL 651	(2005; Rev thru May 2007) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 83	(2003; Rev thru Apr 2006) Standard for Thermoplastic-Insulated Wires and Cables
UL 854	(2004; Rev thru Oct 2007) Service-Entrance Cables

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Precast concrete structures;

Composite/fiberglass handholes;

1.4 NOT USED

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi.

2.1.2 Intermediate Metal Conduit

UL 1242.

2.1.2.1 Intermediate Metal Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi.

2.1.3 Plastic Conduit for Direct Burial

UL 651, Schedule 40 or Schedule 80 NEMA TC 2, EPC-40-PVC or EPC-80-PVC.

2.1.4 Plastic Duct for Concrete Encasement

NEMA TC 6 & 8 and ASTM F 512.

2.1.5 Innerduct

Provide corrugated or solid wall polyethylene (PE) or PVC innerducts with pullwire. Size as indicated.

2.1.6 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials. Inflatable bladders may be used as an option.

2.1.7 Fittings

2.1.7.1 Metal Fittings

UL 514B.

2.1.7.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.7.3 PVC Duct Fittings

NEMA TC 9.

2.1.7.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit shall be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and shall conform to UL 514A.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors shall be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site shall not be accepted. Service entrance conductors shall conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper. As an exception, do not substitute aluminum for copper if the equivalent aluminum conductor size would exceed 500 kcmil.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, shall be 600-volt, Type THWN/THHN conforming to UL 83 conforming to UL 44. Copper conductors shall be annealed copper complying with ASTM B 3 and ASTM B 8.

2.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.2.4 In Duct

Cables shall be single-conductor cable.

2.2.5 Cable Marking

Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Each cable shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations shall be properly identified. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. On three-phase, four-wire delta system, high leg shall be orange, as required by NFPA 70.

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Shall provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

b. For use with aluminum conductors: UL 486A-486B. For connecting aluminum to copper, connectors shall be the circumferentially compressed, metallurgically bonded type.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply NEMA C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as covering or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling in accordance with Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).

2.6 TAPE

2.6.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.6.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

2.7 PULL ROPE

Shall be plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.8 GROUNDING AND BONDING

2.8.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.8.2 Grounding Conductors

Stranded-bare copper conductors shall conform to ASTM B 8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors shall conform to ASTM B 1 for sizes No. 8 and smaller. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Aluminum is not acceptable.

2.9 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.10 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C 857 andASTM C 478. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

2.10.1 Precast Concrete Structures, Risers and Tops

In lieu of cast-in-place, Contractors, at their option, may provide precast concrete underground structures subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.10.1.1 General

Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures

shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.10.1.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads shall include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads shall consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load shall be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads shall include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, shall be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component shall be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

h. Design shall also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.10.1.3 Construction

Structure top, bottom, and wall shall be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment.

However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.10.1.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M 198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.10.2 Handhole Frames and Covers

Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled-steel floor plate having an approved antislip surface. Hinges shall be of stainless steel with bronze hinge pin, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and shall be for full surface application by fillet welding. Hinges shall have nonremovable pins and five knuckles. The surfaces of plates under hinges shall be true after the removal of raised antislip surface, by grinding or other approved method.

2.10.3 Composite/Fiberglass Handholes and Covers

Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758-A and RUS Bull 1751F-644.

3.2 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors shall be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit shall be PVC, Type EPC-40 from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

3.3 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.3.1 Requirements

Depths to top of the conduit shall be in accordance with NFPA 70. Run conduit in straight lines except where a change of direction is necessary. Numbers and sizes of ducts shall be as indicated. Ducts shall have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 3 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in structures.

3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.3.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.3.4 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be PVC coated and shall extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.3.5 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 1/2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.3.6 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.3.7 Conduit and Duct Without Concrete Encasement

Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in3 to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.3.7.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks.

3.3.8 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 1/2 inches, except separate light and power conduits from control, signal, and telecommunications conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring shall be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.3.8.1 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut

steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.3.8.2 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.3.8.3 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

3.4 CONDUCTORS INSTALLED IN PARALLEL

Conductors shall be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.5 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set.

3.6 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 23 00.00 20 EXCAVATION AND FILL.

3.6.1 Reconditioning of Surfaces

3.6.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.6.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.7 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.7.1 Concrete Slabs for Equipment

Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade shall have 1/2 inch chamfer.Slab shall be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.7.2 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.8 FIELD QUALITY CONTROL

3.8.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.8.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

DEPARTMENT OF HOMELAND SECURITY

NON-DISCLOSURE AGREEMENT

The person listed below is an individual official, employee, consultant, or subcontractor of or to the Authorized Entity listed above, intending to be legally bound, hereby consent to the terms in this Agreement in consideration of my being granted conditional access to certain information, specified below, that is owned by, produced by, or in the possession of the United States Government.

Full Name
Authorized Entity

Signer will acknowledge the category or categories of information that he or she may have access to, and the signer's willingness to comply with the standards for protection by placing his or her initials in front of the applicable category or categories.

PROTECTED CRITICAL INFRASTRUCTURE INFORMATION (PCII)	
Initials	I attest that I am familiar with, and I will comply with all requirements of the PCII program set out in the Critical Infrastructure Information Act of 2002 (CII Act) (Title II, Subtitle B, of the Homeland Security Act of 2002, Public Law 107-296, 196 Stat. 2135, 6 USC 101 et seq.), as amended, the implementing regulations thereto (6 CFR Part 29), as amended, and the applicable PCII Procedures Manual, as amended, and with any such requirements that may be officially communicated to me by the PCII Program Manager or the PCII Program Manager's designee.

SENSITIVE SECURITY INFORMATION (SSI)	
Initials	I attest that I am familiar with, and I will comply with the standards for access, dissemination, handling, and safeguarding of SSI information as cited in this Agreement and in accordance with 49 CFR Part 1520, "Protection of Sensitive Security Information," "Policies and Procedures for Safeguarding and Control of SSI," as amended, and any supplementary guidance issued by an authorized official of the Department of Homeland Security.

OTHER SENSITIVE BUT UNCLASSIFIED (SBU)	
Initials	As used in this Agreement, sensitive but unclassified information is an over-arching term that covers any information, not otherwise indicated above, which the loss of, misuse of, or unauthorized access to or modification of could adversely affect the national interest or the conduct of Federal programs, or the privacy to which individuals are entitled under Section 552a of Title 5, as amended, but which has not been specifically authorized under criteria established by an Executive Order or an Act of Congress to be kept secret in the interest of national defense or foreign policy. This includes information categorized by DHS or other government agencies as: For Official Use Only (FOUO); Official Use Only (OUO); Sensitive Homeland Security Information (SHSI); Limited Official Use (LOU); Law Enforcement Sensitive (LES); Safeguarding Information (SGI); Unclassified Controlled Nuclear Information (UCNI); and any other identifier used by other government agencies to categorize information as sensitive but unclassified. I attest that I am familiar with, and I will comply with the standards for access, dissemination, handling, and safeguarding of the information to which I am granted access as cited in this Agreement and in accordance with the guidance provided to me relative to the specific category of information.

ACKNOWLEDGEMENT
1. I hereby acknowledge that I have received a security indoctrination concerning the nature and protection of information to which I have been provided conditional access, including the procedures to be followed in ascertaining whether other persons to whom I contemplate disclosing this information have been approved for access to it, and that I understand these procedures.

2. By being granted conditional access to the information indicated above, the United States Government has placed special confidence and trust in me and I am obligated to protect this information from unauthorized disclosure, in accordance with the terms of this Agreement and the laws, regulations, and directives applicable to the specific categories of information to which I am granted access.

3. I attest that I understand my responsibilities and that I am familiar with and will comply with the standards for protecting such information that I may have access to in accordance with the terms of this Agreement and the laws, regulations, and/or directives applicable to the specific categories of information to which I am granted access. I understand that the United States Government may conduct inspections, at any time or place, for the purpose of ensuring compliance with the conditions for access, dissemination, handling and safeguarding information under this Agreement.

4. I will not disclose or release any information provided to me pursuant to this Agreement without proper authority or authorization. Should situations arise that warrant the disclosure or release of such information I will do so only under approved circumstances and in accordance with the laws, regulations, or directives applicable to the specific categories of information. I will honor and comply with any and all dissemination restrictions cited or verbally relayed to me by the proper authority.

    (a) For PCII - (1) Upon the completion of my engagement as an employee, consultant, or subcontractor under the contract, or the completion of my work on the PCII Program, whichever occurs first, I will surrender promptly to the PCII Program Manager or his designee, or to the appropriate PCII officer, PCII of any type whatsoever that is in my possession.

5. (2) If the Authorized Entity is a United States Government contractor performing services in support of the PCII Program, I will not request, obtain, maintain, or use PCII unless the PCII Program Manager or Program Manager's designee has first made in writing, with respect to the contractor, the certification as provided for in Section 29.8(c) of the implementing regulations to the CII Act, as amended.

6. (b) For SSI and SBU - I hereby agree that material which I have in my possession and containing information covered by this Agreement, will be handled and safeguarded in a manner that affords sufficient protection to prevent the unauthorized disclosure of or inadvertent access to such information, consistent with the laws, regulations, or directives applicable to the specific categories of information. I agree that I shall return all information to which I have had access or which is in my possession 1) upon demand by an authorized individual; and/or 2) upon the conclusion of my duties, association, or support to DHS; and/or 3) upon the determination that my official duties do not require further access to such information.

7. I hereby agree that I will not alter or remove markings, which indicate a category of information or require specific handling instructions, from any material I may come in contact with, in the case of SSI or SBU, unless such alteration or removal is consistent with the requirements set forth in the laws, regulations, or directives applicable to the specific category of information or, in the case of PCII, unless such alteration or removal is authorized by the PCII Program Manager or the PCII Program Manager's designee. I agree that if I use information from a sensitive document or other medium, I will carry forward any markings or other required restrictions to derivative products and will protect them in the same matter as the original.

8. I hereby agree that I shall promptly report to the appropriate official, in accordance with the guidance issued for the applicable category of information, any loss, theft, misuse, misplacement, unauthorized disclosure, or other security violation, I have knowledge of and whether or not I am personally involved. I also understand that my anonymity will be kept to the extent possible when reporting security violations.

9. If I violate the terms and conditions of this Agreement, such violation may result in the cancellation of my conditional access to the information covered by this Agreement. This may serve as a basis for denying me conditional access to other types of information, to include classified national security information.

    (a) With respect to SSI and SBU, I hereby assign to the United States Government all royalties, remunerations, and emoluments that have resulted, will result, or may result from any disclosure, publication, or revelation of the information not consistent with the terms of this Agreement.

    (b) With respect to PCII I hereby assign to the entity owning the PCII and the United States Government, all royalties, remunerations, and emoluments that have resulted, will result, or may result from any disclosure, publication, or revelation of PCII not consistent with the terms of this Agreement.

10. This Agreement is made and intended for the benefit of the United States Government and may be enforced by the United States Government or the Authorized Entity. By granting me conditional access to information in this context, the United States Government and, with respect to PCII, the Authorized Entity, may seek any remedy available to it to enforce this Agreement including, but not limited to, application for a court order prohibiting disclosure of information in breach of this Agreement. I understand that if I violate the terms and conditions of this Agreement, I could be subjected to administrative, disciplinary, civil, or criminal action, as appropriate, under the laws, regulations, or directives applicable to the category of information involved and neither the United States Government nor the Authorized Entity have waived any statutory or common law evidentiary privileges or protections that they may assert in any administrative or court proceeding to protect any sensitive information to which I have been given conditional access under the terms of this Agreement.
11. Unless and until I am released in writing by an authorized representative of the Department of Homeland Security (if permissible for the particular category of information), I understand that all conditions and obligations imposed upon me by this Agreement apply during the time that I am granted conditional access, and at all times thereafter.
12. Each provision of this Agreement is severable. If a court should find any provision of this Agreement to be unenforceable, all other provisions shall remain in full force and effect.
13. My execution of this Agreement shall not nullify or affect in any manner any other secrecy or non-disclosure Agreement which I have executed or may execute with the United States Government or any of its departments or agencies.
14. These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive Order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General or the Office of Special Counsel of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive Orders and statutory provisions are incorporated into this agreement and are controlling.
15. Signing this Agreement does not bar disclosures to Congress, the Special Counsel, the Inspector General of any agency, or any other agency component responsible for internal investigation or review of any information that relates to any violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or any other whistleblower protection. In addition, signing this agreement does not bar disclosure to an authorized official of an executive agency or the Department of Justice that are essential to reporting a substantial violation of law.
16. I represent and warrant that I have the authority to enter into this Agreement.
17. I have read this Non-Disclosure Agreement carefully. The briefing officer (e.g., Special Security Officer) has answered any questions that I had. I acknowledge that the briefing officer has made available to me any laws, regulations, or directives referenced in this document so that I may read them at this time, if I so choose. By applying my digital signature below, the briefing officer accepts that the signature is valid and meets the terms of non-repudiation.

I understand and agree to the following terms and conditions of my access to the information indicated above.

Full Name			
Government/Department/Agency/Business Address			
City	State	Zip Code	Phone
I make this Agreement in good faith, without mental reservation or purpose of evasion.			
Signature			Date

PRIVACY ACT STATEMENT

Authority: Homeland Security Act of 2002; and DHS Management Directive 11042.1, "SAFEGUARDING SENSITIVE BUT UNCLASSIFIED (FOR OFFICIAL USE ONLY) INFORMATION".

Principle Purpose: To execute an agreement between DHS and contractors (or consultants) working for, or on behalf of DHS, to protect DHS Sensitive but Unclassified Information from unauthorized disclosure.

Routine Use(s): The information collected on this form may be disclosed as generally permitted under 5 U.S.C. §552a (b) of the Privacy Act of 1974, as amended. This includes using the information as necessary and authorized by the routine uses published in "DHS/ALL-023 Personnel Security Management System of Records".

Disclosure: Providing this information is voluntary; however, failure to provide this information may prevent the individual from being granted access to DHS Sensitive but Unclassified Information.

U.S. Department of Labor
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. Dec. 2008

OMB No.:1235-0008
Expires: 07/31/2024

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐	ADDRESS	
PAYROLL NO.	FOR WEEK ENDING	PROJECT AND LOCATION / PROJECT OR CONTRACT NO.

(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE — HOURS WORKED EACH DAY	(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS: FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that is will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE.

U.S. Department of Labor
Wage and Hour Division

Davis-Bacon and Related Acts Weekly Certified Payroll Form

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Unless otherwise noted, the information requested is specific to the named project below.

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. January 2025
OMB No.: 1235-0008
Expires: 01/31/2028

☐ SUBMISSION OF FINAL DBRA CERTIFIED PAYROLL FORM ☐ PRIME CONTRACTOR ☐ SUBCONTRACTOR

PROJECT NAME	PROJECT NO. or CONTRACT NO.	CERTIFIED PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME
PROJECT LOCATION	**WAGE DETERMINATION NO.**	**WEEK ENDING DATE**	**PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS ADDRESS**

(1A)	(1B)	(1C)	(1D)	(1E)	(2)	(3)		(4)		(5)	(6A)	(6B)	(6C)	(7A)	(7B)	(8)				(9)
WORKER ENTRY NO.	WORKER LAST NAME	WORKER FIRST NAME	WORKER MIDDLE INITIAL	WORKER IDENTIFYING NO.	(J) JOURNEYWORKER (RA) REGISTERD APPRENTICE	LABOR CLASSIFICATION		ST = STRAIGHT TIME OT = OVERTIME	(TOP) DAYS OF WORK WEEK (BOTTOM) DATES HOURS WORKED EACH DAY	TOTAL HOURS WORKED FOR WEEK	HOURLY WAGE RATE PAID FOR ST AND OT	TOTAL FRINGE BENEFIT CREDIT	PAYMENT IN LIEU OF FRINGE BENEFITS	GROSS AMT EARNED	GROSS AMT EARNED FOR **ALL WORK**	DEDUCTIONS FOR **ALL WORK**				NET PAY TO WORKER FOR **ALL WORK**
																TAX WITH-HOLDINGS	FICA	OTHER (MUST SPECIFY, SEE INSTRUCTIONS)	TOTAL DEDUCTIONS	
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While use of Form WH-347 itself is optional, covered contractors and subcontractors performing work on Federal or federally assisted construction contracts are required by the DBRA regulations and the contract clauses to submit payroll information on a weekly basis. The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federal or federally financed construction contracts to, on a weekly basis, "furnish a statement on the wages paid each employee during the prior week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors and subcontractors to submit weekly certified payrolls to the appropriate Federal agency if the agency is a party to the contract (or, if the agency is not such a party, to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the Federal agency). Each certified payroll must be accompanied by a signed "Statement of Compliance" (e.g., page 2 of the WH-347 or another document with identical wording) indicating that the certified payrolls are accurate and complete, and that each laborer or mechanic has been paid not less than the required Davis-Bacon prevailing wage rate(s) (including any fringe benefits) for the work performed. DOL and contracting agencies receiving this information review the information to determine whether workers have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

PROJECT NAME	PROJECT NO. or CONTRACT NO.	PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME

PROJECT LOCATION	WEEK ENDING DATE	CERTIFYING OFFICIAL's NAME AND TITLE

I paid or supervised the payment of the laborers or mechanics working on the above project during the stated time period. I certify the following:

☐ The payroll information submitted with this statement is correct and complete for the above project during the above period, and the wage and fringe benefit rates paid to the workers, including credit taken for the reasonably anticipated costs of a bona fide fringe benefit plan, fund or program, are not less than the applicable wage and fringe benefits rates for the classification(s) of work actually performed, as specified in the wage determination(s) incorporated into the contract.

☐ All regular payrolls and all other basic records that the contractor is required to maintain for this payroll period are complete and accurate and will be made available upon request from the agency or the Department of Labor.

☐ The classifications reported for each laborer or mechanic are the classification(s) of work that each worker actually performed.

☐ Any workers paid as apprentices during the above period are duly registered in a bona fide apprenticeship program registered with the Office of Apprenticeship, Employment and Training Administration, United States Department of Labor ("OA"), or a State Apprenticeship Agency ("SAA") recognized by Department of Labor. I have verified the registered apprenticeship program information provided below as accurate and applicable to any apprentices identified on page 1 of this form.

APPRENTICESHIP PROGRAM NAME	REGISTERED		NAME OF LABOR CLASSIFICATION
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	

☐ Fringe benefits have been paid in cash and/or to bona fide fringe benefit plans, funds, or programs. Where the contractor is claiming an hourly credit for their contributions to or reasonably anticipated costs of a bona fide fringe benefit plan, fund, or program, provide plan information and the hourly credit claimed for each worker listed on the previous page of this form.

HOURLY CREDIT FOR FRINGE BENEFITS

If an amount is listed in (6B) on the first page of this certified payroll form, enter the hourly credit claimed under each plan name, type and number for each worker and check whether the plan is funded or unfunded.

NAME OF WORKER	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	TOTAL HOURLY CREDIT
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hrly Credit $	$

☐ All workers on the project have been paid the full weekly wages earned, and no rebates or deductions have been or will be made either directly or indirectly, other than permissible deductions as defined in 29 CFR part 3.

ADDITIONAL REMARKS

SIGNATURE OF CERTIFYING OFFICIAL	DATE	TELEPHONE NUMBER	EMAIL ADDRESS
		(___) ___-____	

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION (SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE), AS WELL AS DEBARMENT FROM FUTURE FEDERAL AND FEDERALLY-ASSISTED CONTRACTS. INFORMATION REPORTED IN CERTIFIED PAYROLLS MAY BE SUBJECT TO DISCLOSURE IN RESPONSE TO A FREEDOM OF INFORMATION ACT REQUEST.

Badge Application Addendum for Non-U.S. Citizens, Lawful Permanent Residents and Naturalized U.S. Citizens

Information provided by those completing this form may be used to conduct background checks on the applicant in accordance with FLETC Directive 71-01, Access Control. Privacy Act Statement: This information is provided in accordance with the Privacy Act of 1974 (5 USC 552a). Authority for this information is 5 USC 301, 5 USC 4101 et seq., Executive Order No. 11348, and Department of Homeland Security Delegation 7050. Disclosure of this information is voluntary. Failure to provide requested information may result in denial of access to the FLETC property.

TO BE COMPLETED BY APPLICANT

1. Applicants Full Name: _____

(Last, First, Middle)

Aliases Used (nicknames, maiden names, etc): _____

2.Country of Citizenship: _____

(List more than one if applicable)

Place of Birth: _____

(City, State and/or Country)

3. Status:

- ☐ US Citizen (Naturalized)
- ☐ Permanent Resident — Provide A# _____
- ☐ Non-Immigrant Status — Provide I-94# _____
- ☐ Employment Authorization Card Holder — Provide A# _____
- ☐ Border Crossing Card Holder — Provide Card# _____
- ☐ Other Status — Indicate: _____

4. Non-US Citizens must provide copies of documentation related to their status in the US, including employment authorization, passport and visa.

ATTACHED:

☐ Copy of Passport

if no Passport or Visa exists, insert "None" in provided space

Country of Issue: _____ Passport Number: _____ Date: _____

☐ Copy of Visa

Visa Number: _____ Visa Type: _____ Date: _____

☐ Copy of Naturalization Certificate

☐ Copy of Permanent Resident/Alien Card

☐ Copy of Employment Authorization Card

☐ Border Crossing Card

☐ Other document verifying non-immigrant status

5. I certify the information provided is true and accurate to the best of my knowledge. I acknowledge that knowingly or willingly falsifying information in the document is a violation of 18 US Code Section 1001.

Applicant's Signature: _____ Date: _____

Badge Application Addendum for Non-U.S. Citizens, Lawful Permanent Residents and Naturalized U.S. Citizens

Information provided by those completing this form may be used to conduct background checks on the applicant in accordance with FLETC Directive 71-01, Access Control. Privacy Act Statement: This information is provided in accordance with the Privacy Act of 1974 (5 USC 552a). Authority for this information is 5 USC 301, 5 USC 4101 et seq., Executive Order No. 11348, and Department of Homeland Security Delegation 7050. Disclosure of this information is voluntary. Failure to provide requested information may result in denial of access to the FLETC property.

TO BE COMPLETED BY APPLICANT

1. Applicants Full Name: _____

(Last, First, Middle)

Aliases Used (nicknames, maiden names, etc): _____

2.Country of Citizenship: _____

(List more than one if applicable)

Place of Birth: _____

(City, State and/or Country)

3. Status:

- ☐ US Citizen (Naturalized)
- ☐ Permanent Resident — Provide A# _____
- ☐ Non-Immigrant Status — Provide I-94# _____
- ☐ Employment Authorization Card Holder — Provide A# _____
- ☐ Border Crossing Card Holder — Provide Card# _____
- ☐ Other Status — Indicate: _____

4. Non-US Citizens must provide copies of documentation related to their status in the US, including employment authorization, passport and visa.

ATTACHED:

☐ Copy of Passport

if no Passport or Visa exists, insert "None" in provided space

Country of Issue: _____ Passport Number: _____ Date: _____

☐ Copy of Visa

Visa Number: _____ Visa Type: _____ Date: _____

☐ Copy of Naturalization Certificate

☐ Copy of Permanent Resident/Alien Card

☐ Copy of Employment Authorization Card

☐ Border Crossing Card

☐ Other document verifying non-immigrant status

5. I certify the information provided is true and accurate to the best of my knowledge. I acknowledge that knowingly or willingly falsifying information in the document is a violation of 18 US Code Section 1001.

Applicant's Signature: _____ Date: _____

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
	1		2

2. AMENDMENT/MODIFICATION NUMBER	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQUISITION NUMBER	5. PROJECT NUMBER *(If applicable)*
0001	06/17/2026		

6. ISSUED BY CODE 70LGLY

DEPARTMENT OF HOMELAND SECURITY
FEDERAL LAW ENFORCEMENT TRAINING CENTERS
1131 CHAPEL CROSSING RD
GLYNCO GA 31524

7. ADMINISTERED BY *(If other than Item 6)* CODE 70LGLY

DEPARTMENT OF HOMELAND SECURITY
FEDERAL LAW ENFORCEMENT TRAINING CENTERS
1131 CHAPEL CROSSING RD
PRO BLDG 681
GLYNCO GA 31524

8. NAME AND ADDRESS OF CONTRACTOR *(Number, street, county, State and ZIP Code)*

CODE | FACILITY CODE

(X) **9A. AMENDMENT OF SOLICITATION NUMBER**
70LGLY26RSSB00019

☒ **9B. DATED** *(SEE ITEM 11)*
06/12/2026

10A. MODIFICATION OF CONTRACT/ORDER NUMBER

☐

10B. DATED *(SEE ITEM 13)*

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended. ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or electronic communication which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by letter or electronic communication, provided each letter or electronic communication makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NUMBER AS DESCRIBED IN ITEM 14.

CHECK ONE

☐ A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NUMBER IN ITEM 10A.

☐ B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation data, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).

☐ C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

☐ D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (*Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

See continuation page

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
		Courtney P. Brown	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(Signature of person authorized to sign)		*(Signature of Contracting Officer)*	

Previous edition unusable

STANDARD FORM 30 (REV. 11/2016)
Prescribed by GSA FAR (48 CFR) 53.243

NAME OF OFFEROR OR CONTRACTOR

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Amendment 0001 Solicitation 70LGLY26RSSB00019, B164 Ammo Range Cart Storage Facility is hereby issued for the following: 1. To provide Drawing BG0166 52 Golf cart facility dual OH doors floorplan 2. To provide Drawing BG0166 52 Golf cart facility dual OH doors front view 3. To provide Drawing BG0166 52 Golf cart facility Dual OH doors interior aerial view 4. To provide Drawing BG0166 Range cart aerial view site layout 5. To provide Attachment 9 - WH347_Weekly Certified Payroll Report Form Rev. Jan 2025 6. All other terms and conditions remain unchanged Period of Performance: 07/15/2026 to 01/11/2027				

STATEMENT OF WORK

BG0166 FAD OD Range cart storage facility

1/22/26

Section Index

SECTION 1

1.1 REFERENCES
1.2 DEFINITIONS
1.3 WORK COVERED BY CONTRACT DOCUMENTS
1.3.1 PROJECT DESCRIPTION
1.4 SUBMITTALS
1.5 LOCATION
1.6 CONTRACT DRAWINGS
1.7 BADGING
1.8 WORK SCHEDULING
1.9 COORDINATION, QUALITY CONTROL AND ASSURANCE
1.10 PROJECT ENVIRONMENTAL GOALS
1.11 EXISTING WORK
1.12 ON-SITE PERMITS
1.13 UTILITY OUTAGE REQUESTS AND UTILITY CONNECTION REQUESTS
1.14 LOCATION OF UNDERGROUND FACILITIES

SECTION 2

PRODUCTS

SECTION 3

3.1 PERIOD OF PERFORMANCE
3.2 INSTALLATION
3.3 ATTACHMENTS

SECTION 1

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 2114 (2008) Standard Terminology for Sustainability Relative to the Performance of Buildings

1.2 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E 2114, and as specified.

a) "Environmentally preferable products" have a lesser or reduced effect on the environment in comparison to conventional products and services. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

b.) "Indoor environmental quality" is the physical characteristics of the building interior that impact occupants, including air quality, illumination, acoustics, occupant control, thermal comfort, daylighting, and views.

c) "Operational performance" refers to the functional behavior of the building as a whole or of its components.

d.) "Sustainability" is the balance of environmental, economic, and societal considerations.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

Perform work on IAW contract: Drawings, specifications, reference documents, and contract provisions. Provide all labor, material, equipment, and supervision required to accomplish the following work:

1.3.1 Project Description

The contractor will furnish all labor, materials, equipment, and supervision necessary to accomplish the work detailed herein. The contractor will also verify all quantities, dimensions, and site conditions in the field. The contractor will supply all supplemental and related miscellaneous work to comply with the scope of work as indicated in the Specifications, Statement of Work, and/or Contract.

*NOTE: This project will comply with the Buy American Act whenever possible, ensuring the use of domestically produced materials and products in accordance with applicable regulations.

This project is for the design and construction of a range cart storage facility. The facility will provide secure and weather-resistant storage for Firearms Division range carts and related equipment. Utilizing a design-build approach, the project will integrate the design and construction phases to enhance efficiency, minimize costs, and ensure high-quality outcomes. The contractor will handle all parts of the project, including site evaluation, design, permitting, construction, and final delivery. The facility will meet all required codes, standards, and regulations while supporting operational needs and ensuring durability.

1.3.1a Site Preparation

Site preparation for the range cart storage facility will include all necessary activities to ensure the area is ready for construction. This will involve clearing and grading the site to create a level and stable foundation, removing any debris, vegetation, or obstacles. Soil testing and compaction will be performed as needed to ensure the ground can support the structure. Drainage systems will be installed as needed to prevent water accumulation and protect the facility from potential flooding. Utility connections, such as water, electricity, and other services, will be coordinated and prepared for integration into the building. All site preparation work will comply with applicable codes, regulations, and environmental requirements to ensure safety and long-term stability.

1.3.1a Demolition

Demolition and removal work for the installation of the range cart storage facility will include the removal of two existing light poles, earth, asphalt, trees, and any other items necessary to clear the site for construction. This process will involve safely disconnecting and removing the light poles, excavating and disposing of earth and asphalt materials, and clearing trees and vegetation while adhering to environmental regulations. Any additional items or structures that obstruct the installation of the building will also be removed. All debris and materials will be properly disposed of or recycled in compliance with local, state, and federal requirements. The demolition work will be conducted in a manner that minimizes disruption to surrounding areas and ensures the site is fully prepared for the next phase of construction.

1.3.1b Construction

Note: Drawings will be provided as separate attachments to be used “for reference” for the following:

a) The project involves the installation of an approximately 80' x 160' steel metal building with approximately 12’ eave height on a concrete slab, which will include electrical, water, and sewer connections to support operational needs. The building will feature gutters along both long sides with downspouts for proper drainage and will be equipped with 4-inch-thick insulation to enhance energy efficiency and climate control. The color of the building will be determined from manufacturers standard options.

   The building will be designed to support the load of ceiling-mounted fans, lighting, fire suppression systems, cart electrical retractable cord reels, and all other required equipment. The construction will include a minimum of 26-gauge roof and wall panels for durability. The building will meet wind speed requirements of at least 130 MPH, in accordance with the current local International Building Code (IBC). Concrete to be minimum 4000 PSI with fiber and #4 rebar on 12” centers or otherwise stated by the stamped engineered drawings.

b) The building will include two interior rooms to support specific operational functions. One room, approximately 12' x 12', will feature a secure, non-corrosive metal overhead coiling door with a FLETC approved locking mechanism, a sink for handwashing, and an eyewash/shower combination located outside the room for safety, along with a floor drain for proper water management. The second room will serve as an electrical room, equipped with a thermostat-controlled exhaust fan to regulate temperature and double doors on the exterior of the building for easy access.

c) The electrical system of the building will be designed to support the installation of electrical outlets throughout the building in compliance with code, large ceiling-hung fans, wall-mounted fans, overhead door operators, overhead lighting, spot heaters to maintain a

manageable temperature, and one 120-volt, 20-amp ceiling-mounted retractable cord reel for approximately 60 carts, plus an additional 2 for spares. The electrical design will also incorporate all other building systems and required components. The building's switchgear will be installed in the electrical room, which will feature double doors for easy access and maintenance.

d) Each long side of the building will include two 3/0 metal exterior doors with each having a half glass safety window and protected by exterior stainless steel non-corrosive removeable bollards and yellow sleeve covers for added safety and protection. Use FLETC approved locks and hardware. Doors are to have steel interior structure inside.

The two shorter ends of the building will serve as entrance and exit points, each featuring two metal overhead roll-up doors positioned approximately as shown in the attached drawing, allowing for a roadway for the carts. Additionally, each end will feature a standard 3/0 metal door steel interior structure with a half-glass safety window, FLETC approved hardware and locks, and protected by exterior stainless steel non-corrosive removeable bollards and yellow sleeve covers for added safety and protection. To ensure proper ventilation, a gable fan will be installed at each end of the building, sized to provide adequate airflow.

The overhead roll-up doors will be equipped with electric operators featuring chain assistance for ease of use and reliable operation. The basis of design for the roll-up doors is Overhead Door model 625 or an approved equal meeting all salient characteristics. The basis of design for the overhead door operator is Overhead Door model RHX or an approved equal meeting all salient characteristics. Six remote door operators will be provided, with each remote capable of operating all four roll-up doors` independently. Each roll up door will also have an interior mounted open-close-stop momentary switch for operation of the door. Each roll up door will incorporate a bottom mounted pressure edge for safety. All doors and operators will be programmed and thoroughly checked to ensure proper operation. This includes verifying functionality, remote compatibility, and compliance with project requirements to guarantee reliable and efficient performance.

Each end of the building with roll-up doors will be equipped with a minimum of one LED floodlight. The floodlights will provide adequate illumination for the entrance and exit areas to ensure safety during after-hours use. The lighting will be positioned to effectively cover the roadway and surrounding areas for clear visibility and safe operation.

The building will include eave vents and ridge cap vents to ensure proper airflow and ventilation. Both types of vents will be designed to allow easy closure when needed, providing flexibility to control airflow based on environmental conditions or operational requirements.

The area near the cart repair storage room will include a wall-mounted variable speed fan to ensure proper air circulation. Basis for design is Big Ass fans Aireye or other approved equal with salient characteristics. The fans shall be manufactured in the USA to meet project requirements and ensure compliance with applicable standards. This fan will enhance ventilation in the immediate area, supporting a comfortable and safe environment for operations and equipment maintenance.

The building will include a minimum of three large overhead variable speed fans strategically installed throughout the interior to ensure proper airflow for equipment cooling and ventilation. Basis for design is Big Ass Fans PowerFoil X4 or other approved equal with salient characteristics. The fans shall be manufactured in the USA to meet project requirements and ensure compliance with applicable standards. These fans will be designed to enhance air circulation, maintain a safe environment, and support the efficient operation of equipment within the building.

e) The building shall be equipped with a foam-type fire suppression system specifically designed to accommodate various battery chemistries. This system will provide effective fire protection tailored to the unique risks associated with battery storage and handling, ensuring safety and compliance with applicable fire codes and standards.

The building will be equipped with a heat detection system and a fire alarm panel designed to integrate seamlessly into FLETC's existing fire alarm system. This setup will ensure early detection of potential fire hazards and provide reliable communication with the broader safety infrastructure for prompt response and enhanced protection.

***NOTE:** Honeywell Notifier fire alarm panel and devices will be required for this project. The Contracting Officer (CO) will maintain possession of the brand name justification document.

1.4 SUBMITTALS

Submittals are required for all material and equipment items. They must be reviewed and approved prior to ordering materials and starting construction.

a) All products and/or materials shall conform to the requirements and related specifications of this Statement of Work and shall be first quality, complying with all standards and applicable building codes.

b) The Contractor shall provide submittals to the Contracting Officer Representative (COR). Submittals shall include, but not be limited to, material data sheets, drawings, manufacturer's installation details, AHA & CPL, fall protection plans, Hot Work permits, construction schedule and other documents as required.

***The PM or other government-approving official must verify that all materials comply with the SOW and approved submittals prior to installation and/or the start of construction. If the contractor fails to comply, the CO will be notified immediately that the contractor is not in compliance with the SOW or approved submittals**.

Government approval is required for all submittals, including:

a) Project schedule - Proposed construction dates

b) AHA and CPLs, Accident Prevention Plan, Health and Safety Plan

c) Quality Control plan, Environmental plan, and Work plan

d) Steel building stamped engineered drawings to include foundation

e) Electrical equipment: All wire/cable, breakers, switchgear and all other required electrical components

f) Exhaust fans including gable and electrical room

g) Overhead coil doors, operators, controls, and remotes

h) Coil grill door and hardware for the cart repair storage area

i) Stainless steel removeable bollards and plastic yellow covers

j) Exterior Doors and hardware

k) Commercial electrical cord reels

l) Sink and eyewash/shower combo

m) Floor drain

n) Sewer and drain piping

o) Large ceiling mounted fans and wall mounted fans

p) Foam fire suppression system and shop drawings

q) Heat detection and fire alarm system and shop drawings

r) All paint/coatings, chemicals, including non-corrosive spray

s) Certificates Of Insurance

t) Security Bonds

u) Submittal Register

v) Schedule Of Prices or Earned Value Report

1.5 LOCATION

The work shall be located at the FLETC, GLYNCO GA. Campus, building 252. The exact location will be shown by the Contracting Officer/Contracting Officer's Representative during the site visit.

1.6 CONTRACT DRAWINGS

The following drawings accompany this specification and are a part thereof.

See section 3.3 for attachments.

1.7 BADGING

a) All Government Contractors require badging to enter the FLETC.

b) All badging applications for Contractors and their Subs must be submitted to the Project Manager/Engineer at the time of the Pre-construction meeting if a Pre-construction meeting is required.

c) The Superintendent/QC will be required to keep an updated spreadsheet of all badges associated with this contract.

d) The Spreadsheet shall consist of the following: Company Name, Individual Name, Contract Number, and badge status (Picked up, processing, waiting on fingerprints, etc.). It shall be readily available for the Project Manager and brought to the progress meeting that will be scheduled every two weeks.

1.8 WORK RESCHEDULING

Normal duty hours for work shall be from 7:30 a.m. to 5:30 p.m., Monday through Friday. Requests for additional work shall require written approval from the Contracting Officer 7 days in advance of the proposed work period.

NOTE: Building(s) may be occupied during performance of work under this Contract. Before work starts, arrange with the Contracting Officer a sequence of procedures, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

a) Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work. Submit a written Transportation of Personnel, Materials, and Equipment Plan describing access procedures throughout the project duration.

b) If occupied, building 252 will remain in operation during the entire construction period. The Contractor must conduct his operations to cause the least possible interference with normal activity. Work must be coordinated with circulation patterns within the building. Circulation patterns cannot be closed off entirely.

c) Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing at least 15 calendar days before the desired date of interruption.

d) The work under this contract requires special attention to scheduling and conducting the work in connection with existing operations. Identify on the construction schedule each factor that constitutes a potential interruption to operations.

1.9 COORDINATION, QUALITY CONTROL, AND ASSURANCE

a) Coordinate construction schedule and all construction operations with the Contracting Officer Representative (COR).

b) The Superintendent / QC is responsible for ensuring that all work performed is in accordance with the terms of the Contract.

c) All work is to be inspected by the Government and accepted before the issuance of final payment.

d) The contractor shall verify all measurements, locations, and requirements of the job.

e) The contractor shall keep the construction area maintained throughout the project.

f) All deliveries SHALL be coordinated with the Government Project Manager/COR, all deliveries shall be delivered to the FLETC back gate off Vogel Rd.

g) If the information in the Contract conflicts with that in this Statement of Work, the Contract shall take precedence.

h) The Contractor shall preserve and restore the site ecosystem and biodiversity, avoid site degradation and erosion, and minimize offsite environmental impact.

1.10 PROJECT ENVIRONMENTAL GOALS

The contractor shall distribute copies of the Environmental Goals to each subcontractor and the Contracting Officer. The overall goal for design, construction, and operation is to produce a building that meets the functional program needs and incorporates the principles of sustainability. Specifically:

a) Preserve and restore the site ecosystem and biodiversity; avoid site degradation and erosion. Minimize off-site environmental impact.

b) Use the minimum amount of energy, water, and materials feasible to meet the design intent. Select energy and water-efficient equipment and strategies.

c) Use environmentally preferable products and decrease the toxicity level of materials used.

d) Use renewable energy and material resources.

e) Optimize operational performance (through commissioning efforts) to ensure energy-efficient equipment operates as intended. Consider the durability, maintainability, and flexibility of building systems.

f) Manage the construction site and storage materials to ensure no negative impact on the building's indoor environmental quality.

g) Reduce construction waste through reuse, recycling, and supplier take-back.

1.11 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

a) Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b) Repair or replace portions of existing work, which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.12 ON-SITE PERMITS

Notify the PM and the Contracting Officer at least 48 hours prior to starting excavation work. The contractor is responsible for marking and verifying all utilities. The Contractor shall verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed. Work shall be scheduled to hold outages to a minimum.

Requests for utility outages and connections shall be made by writing to the Contracting Officer and PM at least 2 calendar days in advance of the time required. Each request shall state the system involved, the area involved, the approximate duration of the outage, and the nature of the work involved.

1.13 UTILITY OUTAGE REQUESTS AND UTILITY CONNECTION REQUESTS

Notify the Contracting Officer at least 48 hours before starting the excavation work. The contractor is responsible for marking and verifying all utilities.

The Contractor shall verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified that needs removal. Requests for utility outages and connections need to be in writing to the Contracting Officer at least two days in advance of the time required. Each request shall state the system involved, the area involved, the approximate duration of the outage, and the nature of the work involved. Schedule work to hold outages to a minimum.

1.14 LOCATION OF UNDERGROUND FACILITIES

1.14.1 Notification Prior to Excavation

The contractor shall properly locate all underground utilities by contacting Georgia 811 and FLETC Facilities Management Divisions, Operations Branch (912-267-2413). All utility locates must be called at least one (1) week before beginning work. The 811 locate ticket number and the FLETC Operations Work Order number must be presented to the COR before work begins. Locates have an expiration date; if the locate expires before work has been completed, the contractor shall contact Georgia 811 for a new locate.

SECTION 2 PRODUCTS

Ensure that all products used in the project meet the specified requirements and are installed according to the manufacturer's guidelines and industry standards to ensure the longevity and performance of all installed products.

SECTION 3 EXECUTION

3.1 PERIOD OF PERFORMANCE

Period of performance not to exceed 180 calendar days in which to complete this project from Notice to Proceed (NTP). Notice to proceed shall be issued once all materials are on site and all badging has been approved.

3.2 INSTALLATION

a) All products and materials are installed and constructed using the manufacturer's published instructions, specifications, and industry standards.

b) No product and/or materials shall be installed without the Contractor first receiving written approval from the COR/Engineer regarding submittal items. Materials used on this project are to be submitted and approved/approved prior to use.

c) Acceptance of products/materials shall be accomplished by either furnishing testing results conducted during manufacturing, furnishing manufacturing certification followed by the results of random verification testing, or pre-approving and testing a product or its components prior to utilization.

d) The contractor shall verify all dimensions and conditions prior to beginning work or ordering materials. The contractor shall review site conditions with the Project Manager prior to ordering materials and starting work.

e) The Contractor shall properly locate all underground utilities by contacting Georgia 811 and FLETC Facilities Management Divisions, Operations Branch (912-267-2413). All utility locates must be called at least one (1) week before beginning work. The 811 locate ticket number and the FLETC Operations Work Order number must be presented to the COR before work begins. Locates have an expiration date; if the locate expires before work has been completed, the contractor shall contact Georgia 811 for a new locate.

f) No product and/or materials shall be backfilled without first being inspected by the COR. Any product and/or materials backfilled without first being inspected by the COR shall be excavated at the Contractor's expense to allow for inspection as required by this section of the Statement of Work.

g) Clean out of concrete trucks hauling cast-in-place concrete shall not occur on FLETC property.

h) All work shall be installed/constructed in accordance with specifications, manufacturer-published instructions, and industry standards.

i) All work shall be performed utilizing the latest codes for the work to be accomplished.

j) Material generated by excavation and demolition activity shall fully be recycled when possible, and quantities of all regular wastes and recyclables shall be documented in accordance with the requirements of Specification Section 01 57 19.00 20 entitled “Temporary Environmental Controls”. All waste material shall be disposed of off FLETC property, in accordance with applicable federal, state, and local regulations. The contractor is to provide COR with documentation of the weights of all materials (segregated by material types) recycled and disposed of.

k) *Note: FLETC maintains a sole-source contract with Certified Controls. The contractor must coordinate with Certified Controls to provide and install a proper control system.

3.3 ATTACHMENTS

Attachment “A” – Fire Suppression System design and commissioning

-See the following page-

"Attachment A"

1. Scope:
The contractor shall design, furnish, and install an automatic fire suppression system for the new building as part of this design/build project. The system shall comply with all applicable federal, state, and local fire codes, standards, and regulations, including but not limited to the National Fire Protection Association (NFPA) standards. The contractor shall engage a qualified Fire Protection Engineer (FPE) to evaluate the building's requirements and design a suppression system tailored to the specific application and use of the facility.

2. Requirements:

2.1 Fire Protection Engineer (FPE):
- The contractor shall retain a licensed and certified Fire Protection Engineer (FPE) to evaluate the building's fire protection needs.
- The FPE shall conduct a thorough assessment of the building design, intended use, occupancy type, fire hazards, and applicable codes and standards to determine the most appropriate fire suppression system.
- The FPE shall provide stamped and signed design drawings and calculations for the fire suppression system.

2.2 Design:
- The fire suppression system shall be designed to provide adequate protection for the building and its occupants based on the building's intended use and occupancy classification.
- The design shall comply with NFPA standards, including but not limited to NFPA 13 (Standard for the Installation of Sprinkler Systems), NFPA 14 (Standard for the Installation of Standpipe and Hose Systems), NFPA 20 (Standard for the Installation of Stationary Pumps for Fire Protection), and NFPA 72 (National Fire Alarm and Signaling Code), as applicable.
- The system design shall include all necessary components, such as sprinkler heads, pipes, valves, pumps, control panels, and alarms, to ensure full functionality and compliance.
- The FPE shall evaluate and recommend the type of suppression system most suitable for the building (e.g., wet pipe, dry pipe, pre-action, or other specialized systems).

2.3 Installation:
- The contractor shall furnish all materials, equipment, and labor necessary to install the fire suppression system in accordance with the approved design.
- Installation shall be performed by qualified personnel with experience in fire suppression systems.
- The contractor shall coordinate with other trades to ensure seamless integration of the fire suppression system with the building's construction and systems.

2.4 Testing and Commissioning:
- Upon completion of installation, the contractor shall perform all required testing and commissioning of the fire suppression system to ensure proper functionality and compliance with applicable standards.
- Testing shall include hydrostatic testing, flow testing, alarm testing, and any other required tests as specified by NFPA standards.

- The contractor shall provide documentation of all tests and certifications to the Contracting Officer or designated representative.

2.5 Documentation and Training:

- The contractor shall provide as-built drawings, system manuals, and maintenance instructions for the fire suppression system.
- The contractor shall conduct training for facility personnel on the operation and maintenance of the system.

3. Deliverables:

- Fire suppression system design drawings and calculations stamped by the FPE.
- Documentation of testing and commissioning results.
- As-built drawings and system manuals.
- Training for facility personnel.

4. Compliance: The fire suppression system shall comply with the following standards and regulations:

- NFPA standards (e.g., NFPA 13, NFPA 14, NFPA 20, NFPA 72, etc.).
- International Building Code (IBC).
- International Fire Code (IFC).
- Local and state fire codes and regulations.

5. Schedule:

The contractor shall ensure the fire suppression system design, installation, testing, and commissioning are completed in accordance with the overall project schedule.

6. Quality Assurance:

The contractor shall implement quality assurance measures to ensure the fire suppression system meets all design and performance requirements.

Federal Law Enforcement Training Centers

GLYNCO, GEORGIA

-End of Statement-

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SECTION 01 14 00

WORK RESTRICTIONS

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Not used

1.2 NOT USED

1.3 CONTRACTOR ACCESS AND USE OF PREMISES

1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. To minimize traffic congestion, delivery of materials shall be outside of peak traffic hours (6:30 to 8:00 a.m. and 3:30 to 5:00 p.m.) unless otherwise approved by the Contracting Officer. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.3.1.1 Subcontractors and Personnel Contacts

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.3.1.2 Identification Badges and Installation Access

Identification badges are required and will be furnished without charge. Application for and use of badges will be as directed by the Contracting Officer. Immediately report instances of lost or stolen badges to the Contracting Officer. See Section H regarding lost badges. All badges must be immediately returned to the point of issue upon badge expiration, contract completion, firing or removal of employee, or at the request of the approving authority.

1.3.1.3 Employee List

The Contractor shall provide to the Contracting officer, in writing, the names of two designated representatives authorized to request personnel and vehicle passes for employees and subcontractor's employees prior to commencement of work under this contract.

1.3.1.4 Personnel Entry Approval

Failure to obtain entry approval will not affect the task order price or time of completion.

1.3.1.5 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installations under the cognizance of FLETC except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.3.2 Working Hours

Normal working hours shall consist of an 8 hour period established by the Contractoing Officer, between 7:30 a.m. and 4:30 p.m., Monday through Friday, excluding Government holidays.

1.3.3 Work Outside Regular Hours

Work outside (Normal) working hours requires Contracting Officer approval. Make application 3 to 5 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.

1.3.4 Occupied and Existing Buildings

The Contractor will be working in existing occupied buildings.

The existing buildings and their contents shall be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the building during the construction period.

1.3.5 Utility Cutovers and Interruptions

a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."

b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and sprinkler shall be considered utility cutovers pursuant to the paragraph entitled "Work Outside Normal Hours." Such interruption shall be further limited to 8 hours. This time limit includes time for deactivation and reactivation.

d. Operation of Station Utilities: The Contractor shall not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

1.4 SECURITY REQUIREMENTS

1.4.1 Citizenship Requirements

Aliens are not allowed on the project site. Work under this contract is restricted to U.S. citizens.

1.4.2 Documents Acceptable for Proof of Citizenship

a. Birth registration card

b. Certificate of live birth, birth certificate

c. Certificate of registration

d. Delayed birth certificate

e. Hospital birth certificate

f. Military officer ID card

g. USA passport

1.4.3 Passes

Submit request for personnel and vehicle passes together. Include the Certificate of Insurance for Contractor and Subcontractor(s) and the Statement of Acknowledgement Form SF 1413 with the submittal. Passes will normally be issued within 21 days, see Section H.

1.4.3.1 Control

Maintain strict accountability over passes. Immediately report to the source of issue, passes missing or lost and the circumstances.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

Requirements of this Section apply to, and are component to, each section of the specifications.

The Government may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Contractor's Quality Control Manager (QCM) to check and approve all items prior to submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval will be identified by each task order and are to be scheduled and made prior to the acquisition of the material or equipment covered thereby.

Submittals will be received from the Contractor and returned to the Contractor in designated mail boxes located at the FMD Office Building 200.

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Certificates of insurance
Surety bonds
Qualifications, Certifications, Resumes, Letters of Commitment, and Appointment Letters for all Key Personnel: Quality Control Manager (QCM), Alternate Quality Control Manager, Project Manager(PM), Alternate Project Manager, Superintendent, and Alternate Superintendent.
List of proposed subcontractors and suppliers
Accident Prevention and Health and Safety Plans
Quality Control (QC) plan
Environmental Protection and Waste Management Plan
Indoor Air Quality Management Plan
Activity Hazard Analysis (AHA) (designated per Task Order)

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.1.2 Approving Authority

Project Manager/COR designated person authorized to approve submittal.

1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTALS

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

SD-01 Preconstruction Submittals

> The below listed Pre-Construction Submittals are critical, if the award constitutes pre-construction submittals to start work activities and are required to be provided to the Government a minimum of seven (7) calendar days, (unless stated other-wise stated in the SOW, per task order), prior to the scheduled Preconstruction Conference and will require Government approval prior to Notice to Proceed and work commencement on site. Make any required Pre-Construction Re-Submittals within five (5) calendar days after Government rejection. Neglect to provide timely approved Pre-Construction submittals and to employ approved key on-site Project Manager, Quality Control Manager and Superintendent personnel will not be the basis for time extension, claim under the Contract, nor will it be subject to the Disputes clause. Submit four (2) submittal copies for Government retention PLUS the number of copies requested for return back to the Contractor.

See the related Division 1 specification sections such as Quality Control, Project Schedule, Environmental Controls/Management, Waste Management, Safety Requirements:

Certificates of insurance; Surety bonds;
Qualifications, Certifications, Resumes, and Appointment Letters for Quality Control Manager, Project Manager and Superintendent; List of proposed subcontractors and suppliers;
Accident Prevention and Safety plan; Quality Control (QC) plan;
Environmental Protection and Waste Management plan; Indoor Air Quality Management Plan
Schedule
Activity Hazard Analysis(AHA)for and DOFW per Task Order

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved

Submittal is required in accordance with all contract requirements and prior to fabrication, delivery, and start of any related work activity. The Government reserves the right to suspend work activities initiated without approved submittals. Government approval is required for submittals identified in each task order. Government approval is required for any deviations from the Accepted Proposal and other items as designated by the Contracting Officer.

1.3.2 QCM Approved - Information Only

Submittals not requiring Government approval will be approved by the Quality Control Manager and made available to the Government if requested for information only. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Government from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.4.1 Submittals Required from the Contractor

Required submittals must be approved in writing by a Government Representative(PM/COR) before procurement or fabrication of any proposed materials or methods in the (SOW) per for each task order. Forward the required submittals to the Project Manager/COR and copy the Contracting Officer with the FMD-74 transmittal sheet. The Government PM for each task order will review stamp submittals to verify submittals comply with the contract requirements.

1.4.1.1 O&M Data

The Government PM for each task order will review O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

a. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to the Project Manager/COR. Transmit each copy of the submittal in the format of the Agency sample transmittal form FTC-FMD-74 furnished by the Government. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample mock-ups, installations, panels.

Properly complete this form by filling out all the heading blank spaces and identifying each item submitted by section, submittal description (SD) number, and paragraph reference number. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item. Assign each submittal a transmittal number.

1.5.2 Identifying Submittals

When submittals are provided by a lower tier contractor the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Task Order title and location.

b. Task Order number.

c. Date of the submittal.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier Contractor associated with submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. For resubmittals, add an alphabetic suffix on the submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

i. Quality Control Manager's certification stamp.

1.5.3 Format for SD-02 Shop Drawings

a. Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

b. Present A4 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."

d. Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

e. Reserve a blank space on the right hand side of each sheet for the Government disposition stamp.

f. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

g. Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

h. Reproductions of the task order drawings will not be accepted as shop drawings. Such submittals will be rejected.

1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

a. Present product data submittals for each section as a complete set. Include table of contents, listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

c. Provide product data in English dimensions.

d. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

e. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

f. Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically.

g. Submit manufacturer's instructions prior to installation.

1.5.5 Format of SD-04 Samples

a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

(1) Sample of Equipment or Device: Full size.

(2) Sample of Materials Less Than 2 by 3 inches: Built up to A4 8 1/2 by 11 inches.

(3) Sample of Materials Exceeding A4 8 1/2 by 11 inches: Cut down to A4 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

(4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

(5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

(7) Sample Panel: 4 by 4 feet.

(8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.5.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

a. Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

b. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.5.8 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

b. Provide all dimensions in administrative submittals in English units.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies on SD-01 Preconstruction Submittals

Submit four copies of Preconstruction submittals.

1.6.2 Number of Copies of SD-02 Shop Drawings

Submit three copies of submittals of shop drawings.

1.6.3 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.4 Number of Samples SD-04 Samples

a. Submit three samples or sets of samples showing range of variation, of each required item. Two approved samples or sets of samples will be retained by approving authority and one will be returned to Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit three samples of non-solid materials.

1.6.5 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.6.6 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.7 Number of Copies of SD-10 Operation and Maintenance Data

Submit two copies of O&M Data to the Government for review and approval.

1.6.8 Number of Copies of SD-11 Closeout Submittals

Unless otherwise specified, submit two sets of Close-Out submittals.

1.6.9 Copies Not Indicated

Provide two copies of submittals when a number of submittal copies are not otherwise identified.

1.7 VARIATIONS / SUBSTITUTION REQUESTS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.7.1 Considering Variations

Discussion with Contracting Officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.7.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.7.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.7.4 Variations Review Schedule

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.8 SUBMITTAL REGISTER

The Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

Coordinate the submittal dates with the related project activities to avoid any delay to work progress. Revise the submittal register when the progress schedule is revised and submit both for approval.

1.8.1 Use of Submittal Register

Verify that all submittals required for a task order are tracked in the submittal register.

1.9 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time.No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirement and refer to time period in section 1.2 Submittals.

1.9.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is the QC Manager unless submittals are specifically identified in a task order. Request for submittals in a task order signifies the requirement for Government Approval for only those submittals identified.

1.9.2 Constraints

a. Conform to provisions of this section, unless explicitly stated otherwise by a task order.

b. Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.9.3 QC Organization Responsibilities

It is the responsibility of the QC manager to coordinate all submittals with subcontractors, manufacturers, suppliers, etc. to insure all submittals are complete and represent entire systems where multiple subcontractors, supplier, etc. combine to make up an operating system.

a. Note date on which submittal was delivered by Contractor on each transmittal.

b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.

c. Review submittals for conformance with task order design concepts and compliance with contract documents.

d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

e. Ensure that material is clearly legible. Submittals containing illegible materials will be entirely rejected.

f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is Project Manager/COR, QC organization will certify submittals forwarded to Project Manager/COR with the following certifying statement:

"I hereby certify that the equipment, material, article shown and marked in this submittal is that proposed to be incorporated with contract Number__, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Certified by QC Manager_____, Date_____"
(Signature)

(2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the material, equipment, article shown and marked in this submittal and proposed to be incorporated with contract Number, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Approved by QC Manager_____, Date_____"
(Signature)

g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.

Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Government.

i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

1.10 GOVERNMENT APPROVING AUTHORITY

When approving authority for submittals is the Project Manager/COR the Government will:

a. Note date on which submittal was received from QC Manager.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph entitled "Submittal Actions" and with markings appropriate for action indicated.

Two copies of approved submittals will be retained by the Government and the remaining copies of the submittal will be returned to the Contractor, excluding O&M and Close-Out submittals.

1.10.1 Review Notations

Submittals will be returned with the following notations:

a. Submittals marked "approved" authorize the Contractor to proceed with the work covered.

b. Submittals marked "approved as noted" "or approved except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required , does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.11 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Government. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the task order drawings or specifications; notice as required under the clause entitled, "Changes" is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.12 APPROVED SUBMITTALS

The Government's approval or acceptance of submittals is not be construed as a complete check. Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for verification of dimensions and the compliant construction of all work.

After submittals have been approved or accepted by the Government, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.13 APPROVED SAMPLES

Approval of a sample is not to be construed to change or modify any contract requirements. Before submitting samples, the Contractor is to assure that the materials or equipment will be available in quantities required in the project. No substitution will be permitted after a sample has been approved.
Match the approved samples for Materials and equipment incorporated in the work. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to

disapproved any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Project Manager /COR for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Project Manager/COR does not relieve the Contractor of his responsibilities under the contract.

1.14 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made if all required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Contract.

1.15 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
E-mail: amca@amca.org
Internet: http://www.amca.org

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
2111 Wilson Blvd, Suite 500
Arlington, VA 22201
Ph: 703-524-8800
Fax: 703-528-3816
E-mail: fdietz@ahrinet.org
Internet: http://www.ahrinet.org

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209

Ph: 703-358-2960
Fax: 703-358-2961
Internet: http://www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-5774
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: webmaster@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
1 Davis Drive
P.O. Box 12215
Research Triangle Park, NC 27709
Ph: 919-549-8141
Fax: 919-549-8933
E-mail: leonardc@aatcc.org
Internet: http://www.aatcc.org

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
2025 M Street, NW, Suite 800
Washington, DC 20036
Ph: 202-367-1155
Fax: 202-367-2155
E-mail: info@americanbearings.org
Internet: http://www.abma-dc.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240
Ph: 513-742-2020 or 513-742-6163
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: http://www.acgih.org

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)
2700 Prosperity Ave., Suite 250
Fairfax, VA 22031
Tel: 703-849-8888
Fax: 703-207-3561
E-mail: infonet@aiha.org
Internet http://www.aiha.org

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 700

Chicago, IL 60601-1802
Ph: 312-670-2400
Fax: 312-670-5403
Publications: 800-644-2400
E-mail: pubs@aisc.org
Internet: http://www.aisc.org

AMERICAN IRON AND STEEL INSTITUTE (AISI)
1140 Connecticut Avenue, NW, Suite 705
Washington, DC 20036
Ph: 202-452-7100
Fax: 202-463-6577
E-mail: webmaster@steel.org
Internet: http://www.steel.org

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)
P.O. Box 210
Germantown, MD 20875-0210
Ph: 301-972-1700
Fax: 301-540-8004
E-mail: alsc@alsc.org
Internet: http://www.alsc.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1819 L Street, NW, 6th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: info@ansi.org
Internet: http://www.ansi.org/

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)
10003 Derekwood Lane, Suite 210
Lanham, MD 20706
Ph: 301-459-3200
Fax: 301-459-8077
Internet: http://www.arema.org

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191-4400
Ph: 703-295-6300 - 800-548-2723
Fax: 703-295-6333
E-mail: member@asce.org
Internet: http://www.asce.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: http://www.ashrae.org

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

1800 East Oakton Street Des
Plaines, IL 60018-2187
Ph: 847-699-2929
Fax: 847-768-3434
E-mail: customerservice@asse.org
Internet:http://www.asse.org

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
901 Canterbury, Suite A
Westlake, OH 44145
Ph: 440-835-3040
Fax: 440-835-3488
E-mail: info@asse-plumbing.org
Internet: http://www.asse-plumbing.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Ph: 800-926-7337
Fax: 303-347-0804
E-mail: smorrison@awwa.org
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
550 N.W. LeJeune Road
Miami, FL 33126
Ph: 800-443-9353 - 305-443-9353
Fax: 305-443-7559
E-mail: info@aws.org or customerservice@awspubs.com
Internet: http://www.aws.org

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
E-mail: email@awpa.com
Internet: http://www.awpa.com

APA - THE ENGINEERED WOOD ASSOCIATION (APA)
7011 South 19th St.
Tacoma, WA 98466-5333
Ph: 253-565-6600
Fax: 253-565-7265
E-mail: help@apawood.org
Internet: http://www.apawood.org

ARCHITECTURAL WOODWORK INSTITUTE (AWI)
46179 Westlake Drive, Suite 120
Potomac Falls, VA 20165
Ph: 571-323-3636
Fax: 571-323-3630
E-mail: info@awinet.org
Internet: http://www.awinet.org

ARCNET TRADE ASSOCIATION (ATA)

E-M-mail: info@arcnet.com
Internet: http://www.arcnet.com/index.htm</URL

ASME INTERNATIONAL (ASME)
Three Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-854-7179 or 800-843-2763
Fax: 212-591-7674
E-mail: infocentral@asme.org
Internet: http://www.asme.org

ASSOCIATED AIR BALANCE COUNCIL (AABC)
1518 K Street, NW
Washington, DC 20005
Ph: 202-737-0202
Fax: 202-638-4833
E-mail: info@aabc.com
Internet: http://www.aabchq.com

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9585
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
355 Lexington Avenue
15th Floor
New York, NY 10017
Ph: 212-297-2122
Fax: 212-370-9047
E-mail: assocmgmt@aol.com
Internet: http://www.buildershardware.com

CALIFORNIA ENERGY COMMISSION (CEC)
Media and Public Communications Office
1516 Ninth Street, MS-29
Sacramento, CA 95814-5512
Ph: 916-654-4287
Internet: http://www.energy.ca.gov/

CARPET AND RUG INSTITUTE (CRI)
P.O. Box 2048
Dalton, GA 30722-2048
Ph: 800-882-8846 or 706-278-3176
Fax: 706-278-8835
Internet: http://www.carpet-rug.com

CAST IRON SOIL PIPE INSTITUTE (CISPI)
5959 Shallowford Road, Suite 419
Chattanooga, TN 37421
Ph: 423-892-0137
Fax: 423-892-0817
Internet: http://www.cispi.org

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)
1300 Sumner Avenue
Cleveland OH 44115-2851
Ph: 216-241-7333
Fax: 216-241-0105
E-mail: cffa@chemicalfabricsandfilm.com
Internet: http://www.chemicalfabricsandfilm.com/

COMPOSITE PANEL ASSOCIATION (CPA)
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176
Ph: 703-724-1128
Fax: 703-724-1588
Internet: http://www.pbmdf.com

COMPRESSED GAS ASSOCIATION (CGA)
4221 Walney Road, 5th Floor
Chantilly, VA 20151
Ph: 703-788-2700
Fax: 703-961-1831
E-mail: cga@cganet.com
Internet: http://www.cganet.com

CONSUMER ELECTRONICS ASSOCIATION (CEA)
1919 South Eads St.
Arlington, VA 22202
Ph: 866-858-1555 or 703-907-7600
Fax: 703-907-7675
E-mail: cea@CE.org
Internet: http://www.CE.org

COPPER DEVELOPMENT ASSOCIATION (CDA)
260 Madison Avenue
New York, NY 10016
Ph: 212-251-7200
Fax: 212-251-7234
E-mail: questions@cda.copper.org
Internet: http://www.copper.org

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)
513 West Broad St., Suite 210
Falls Church, VA 22046-3257
Ph: 800-294-3462
Fax: 703-538-1736
E-mail: lwidzowski@eima.com
Internet: http://www.eima.com

FLUID SEALING ASSOCIATION (FSA)
994 Old Eagle School Rd. #1019
Wayne, PA 19087
Ph: 610-971-4850
E-mail: info@fluidsealing.com
Internet:www.fluidsealing.com

FM GLOBAL (FM)
270 Central Avenue

P.O. Box 7500
Johnston, RI 02919
Ph: 401-275-3000 ext. 1945
Fax: 401-275-3029
E-mail: servicedesk.myrisk@fmglobal.com
Internet: http://www.fmglobal.com

FOREST STEWARDSHIP COUNCIL (FSC)
212 Third Avenue North
Suite 280 Minneapolis,
MN 55401
Ph: 612-353-4511
Fax: 612-208-1565
E-mail: info@fscus.org
Internet: http://www.fscus.org

GEORGIA DEPARTMENT OF NATURAL RESOURCES

2 Martin Luther King Jr. Drive, SE
Suite 1252, East Tower
Atlanta, GA 30334
Ph: 404-656-3500
Internet: <URL>http://www.gadnr.org</URL>

GLASS ASSOCIATION OF NORTH AMERICA (GANA)
2945 SW Wanamaker Drive, Suite A
Topeka, KS 66614
Ph: 785-271-0208
Fax: 785-271-0166
E-mail: gana@glasswebsite.com
Internet: http://www.glasswebsite.com

GREEN SEAL (GS)
1001 Connecticut Avenue, NW
Suite 827
Washington, DC 20036-5525
Ph: 202-872-6400
Fax: 202-872-4324
E-mail: greenseal@greenseal.org
Internet: http://www.greenseal.org

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)
2211 Newmarket Parkway, Suite 110
Marietta, GA 30067
Ph: 800-427-9681
Fax: 770-980-0072
E-mail: info@greenguard.org
Internet: http://www.greenguard.org/

GYPSUM ASSOCIATION (GA)
6525 Belcrest Road, Suite 480
Hyattsville, MD 20782
Ph: 301-277-8686
Fax: 301-277-8747
E-mail: info@gypsum.org
Internet: http://www.gypsum.org

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)
1825 Michael Faraday Dr.
Reston, VA 20190
Ph: 703-435-2900
Fax: 703-435-2537
E-mail: hpva@hpva.org
Internet: http://www.hpva.org

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)
120 Wall Street, 17th Floor
New York, NY 10005
Ph: 212-248-5000
Fax: 212-248-5018
E-mail: iesna@iesna.org
Internet: http://www.iesna.org

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)
1901 North Moore Street
Arlington, VA 22209-1762
Ph: 703-525-1695
Fax: 703-528-2148
E-mail: isea@safety equipment.org
Internet: http://www.safetyequipment.org/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 Hoes Lane or 2001 L Street, NW. Suite 700
Piscataway, NJ 08855-1331 or Washington, DC 20036-4910 USA
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-6380
E-mail: onlinesupport@ieee.org or ieeeusa@ieee.org
Internet: http://www.ieee.org

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 1568
Carrollton, GA 30112
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PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00

CONSTRUCTION QUALITY CONTROL AND KEY PERSONNEL

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Requirements of this Section apply to, and are component of, each section of the specifications.

1.2 DEFINITIONS

Reference to the Government COR and Construction Representative (ConRep) herein refers to the FLETC Facilities Management Division Project Manager and Construction Representative.

1.3 SUBMITTALS

Approval is required for submittals as identified by each task order. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

The below listed Pre-Construction Submittals are critical to start of work activities and are required to be provided to the Government a minimum of seven (7) calendar days prior to the scheduled kick-off Preconstruction Conference All Pre-Construction submittals require Government approval. Make any required Pre-Construction Re-Submittals within five (5) calendar days after Government rejection. Neglect to provide timely approved Pre-Construction submittals and to employ approved key on-site Project Manager, Quality Control Manager and Superintendent personnel will not be the basis for time extension, claim under the Contract, nor will it be subject to the Disputes clause. Submit four (4) submittal copies for Government retention PLUS the number of copies requested for return back to the Contractor.

Construction Quality Control (QC) Plan;

Submit a QC Plan in accordance with the requirements of this Section. Acceptance of the QC Plan is required prior to start of construction work.

Key Personnel Resumes, Qualifications, Letters of Commitment, Certificates and Appointment Letters;

Key personnel are the Contractor's: Project Manager (PM), Alternate PM, Quality Control Manager (QCM), Alternate QCM, Superintendent, and Alternate Superintendent. Alternates are held to the same standards as the primary position holders. Requirements specified herein for the primary PM, CQM, and Superintendent position holders are equally applicable to the Alternate position holders when they are serving in their designated alternate position capacity.

Upon initial solicitation key personnel were vetted and the associated skill sets considered. Should replacement personnel be deemed prudent by the Contractor, the individual replacement personnel shall have equal or greater skill set than the person they are replacing. Prior to replacement of those key positions outlined, the contractor shall submit qualifications and experience in resume format. Include: resume; letters of commitment attesting to the candidates' availability signed by an officer of the Contractor and the proposed candidates; and appointment letters signed by an officer of the Contractor for review and approval. Submit qualifications and experience information in resume format and include attachments as necessary. Include formal educational experience, copies of diplomas and training certificates, chronological work history, positions held, descriptions of duties and responsibilities, relevant project descriptions and demonstration of satisfaction of the required qualifications. Provide additional information as requested.

Submit for Government review no later than seven (7) calendar days prior to the scheduled replacement.

Acceptable key personnel qualifications, performance, and organizational observance of required PM, QCM and Superintendent authorities are considered critical to success of task orders executed under this contract. Required authorities of the PM, QCM and Superintendent are described in this Section and are to be acknowledged in the Appointment Letters. Government approval of replacement key personnel is necessary prior to assignment of the replacement.

Contractor Safety Plan;

Provide a comprehensive Safety Plan in accordance with the related Section for SAFETY REQUIREMENTS. The Safety Plan comprises, but is not limited to, an Accident Prevention Plan (APP), Activity Hazard Analysis (AHA), Health and Safety Plan, provision of proposed Safety Officer Training Records and Qualifications.

Contractor Environmental Plan;

Provide a comprehensive Environmental, Indoor Air Quality and Waste Management Plan in accordance with the related Sections for CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT and TEMPORARY ENVIRONMENTAL CONTROLS. Provide required Environmental Officer Training Records and Qualifications.

1.4 REPORTING FORMS

Use reporting forms provided in the contract or obtain a single copy of forms from the Facilities Management COR. The report forms will consist of the Superintendent's Daily Report (FTC-FMD-42) and the Quality Control Manager's Daily Report (FTC-FMD-67). Other forms shall be developed by the Contractor and submitted for approval of the Government for reporting of QC Meeting Agendas and Minutes, Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, Requests For Information (RFI), Field Test

Reports, and Testing Plan and Log. Submit electronic daily reports via email to both the Facilities Management Division. Copy the Government COR /Pm, and ConRep (if assigned).

Deliver the following to the assigned Government task order Project Manager during Construction:

a. Superintendent's and QCM's Reports: Electronically transfer completed and signed daily reports to the Facilities Management Division assigned Project Manager and Contracting Officer by 10:00 AM the next working day. Provide daily reports for all working and non-working days through the date of final acceptance of all work. Annotate non-working days accordingly on reports.

b. Preparatory Phase Checklist: Original attached to the original QCM Report and one copy attached to each QCM Report copy.

c. Initial Phase Checklist: Original attached to the original QCM Report and one copy attached to each QCM Report copy.

d. Field Test Reports: Hand-carry the original within two working days after the test is performed, attached to the original QCM Report and one copy attached to each QCM Report copy.

1.5 KEY PERSONNEL AND QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. This QC program is a key element in meeting all project objectives of timely and quality performance. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), QC meetings, three phases of control, submittal review and approval, testing, completion inspections, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No construction work or testing may be performed without an approved Quality Control Manager AND Superintendent being physically present on the FLETC premises. Duties requiring departure from the site during any work activities shall be performed by personnel other than the QC Manager and Superintendent. Absence of these key personnel or their approved alternates from the FLETC premises during work activities can result in work stoppage, contract price reduction, staffing removal, and/or other actions as determined by the Government. The QC Manager shall report to an Officer of the firm and shall not be subordinate to the field Project Manager or Superintendent. The QC Manager, PM and Superintendent must work together effectively. Although the QC Manager is the primary individual responsible for quality control, the PM and Superintendent are accountable for the quality of work produced under their supervision. The Contractor shall maintain a competent approved PM, QCM and Superintendent at the FLETC premises at all times work is being performed.

Designated Alternate key personnel must be available on-site in the event of absence of the primary key person(s).

1.5.1 Commissioning

Commissioning (Cx) is a systematic process of ensuring that all building systems meet the requirements and perform interactively according to the Contract. The QC Program is a key to this process by coordinating, verifying and documenting measures to achieve the following objectives:

a. Verify and document that the applicable equipment and systems are installed in accordance with the design intent as expressed through the Contract and according to the manufacturer's recommendations and industry accepted minimum standards.

b. Verify and document that equipment and systems receive complete operational checkout by the installing contractors.

c. Verify and document proper performance of equipment and systems.

d. Verify that Operation and Maintenance (O&M) documentation is complete.

e. Verify and document that the Government's operating personnel are adequately trained.

1.5.2 Acceptance of the Construction Quality Control (QC) Plan and Key Personnel

Acceptance of the QC Plan is required prior to the start of construction activities. The Government reserves the right to require changes in the QC Plan and operations as necessary. The Government reserves the right to interview any personnel at any time in order to evaluate and verify personnel qualifications and a suitable level of work performance. The PM, Superintendent and QCM organization personnel shall be subject to acceptance by the COR. If at any time during the Contract performance period, should key personnel's job performance fall below a reasonable standard of competence, professionalism, attendance, or should performance be otherwise objectionable, he/she shall be promptly replaced by the Contractor upon request from the Government. Neglect to maintain an effective Quality Control Program and acceptable key Quality Control and Superintendent Personnel will not be the basis for claim under the Contract nor will it be subject to the Disputes clause. All persons are subject to a background criminal investigation at the discretion of the Federal Law Enforcement Training Center.

1.5.3 Notification of Changes

Notify the COR/PM, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel, a minimum of 10 work days prior to a proposed change. Proposed changes shall be subject to acceptance by the COR. Notify the COR in advance when the Alternate PM, QCM or Superintendent will temporarily assume duties as necessitated by an absence of the primary person(s).

1.6 CONTRACTOR KEY PERSONNEL

All key personnel shall be direct employees of the prime Contractor and shall be on-site on normal working days at least between the Normal hours of 7:30 a.m. and 4:30 p.m. At a minimum, one (1) of the key personnel (Project Manager, Project Superintendent, QC Manager and alternates, if

applicable) must always be onsite during Normal hours.

1.6.1 Quality Control Manager (QCM)

1.6.1.1 Duties

Provide an on-site QC Manager to implement and manage the QC program. The QC Manager shall devote his time exclusively to work under this contract only. The QC Manager shall devote his time exclusively to the work under this contract only and shall be on-site at least on normal working days between the Normal hours of 7:30 a.m. and 4:30 p.m. The QC Manager shall: administer the three phases of quality control, have the authority to stop work, require work replacement, direct subcontractor performance with regard to quality, issue and enforce Contractor non-compliance notices with respect to all work. The QC Manager shall not be designated as the safety competent person as defined by the adopted U.S. Army Corps of Engineers (USACE) Safety Manual EM 385-1-1. The QC Manager is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meeting, Progress Meetings, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of quality control and documentation performed by testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

1.6.1.2 QC Manager Qualifications

As a minimum, the individual shall demonstrate completion of High School level education. The individual shall possess a total cumulative minimum of ten (10) years combined experience on similar private or Federal construction projects in the following positions: Project Superintendent, QC Manager, Project Manager, or Construction Manager. Of this cumulative experience, at least five years' experience shall be as a QC Manager on similar United States Military or Federal agency construction contract. Similar construction contracts are defined to be of comparable cost, type and complexity of work and including the major trades that are part of this Contract. The individual shall be experienced with Federal administrative construction processes. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). In addition to the above experience and education requirements, the QC Manager shall have completed the course entitled "Construction Quality Management (CQM) for Contractors." If the QC Manager does not have a current certification, he/she shall obtain the CQM for Contractors course certification within 30 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact these organizations for information on the next scheduled class. The individual must be familiar with the safety requirements of USACE EM 385-1-1 and/or OSHA 1926 Construction and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, Outlook (e-mail). The individual must demonstrate a working

knowledge and familiarity with Critical Path Network scheduling and be familiar with MS Project or similar project management software.

1.6.1.3 Alternate QC Manager Duties and Qualifications

The Government approved and authorized alternate QC Manager shall be available on-site to serve in the event of the designated primary QC Manager's absence. The Alternate QC Manager Qualifications shall be the same the QC Manager's.

1.6.2 Superintendent

1.6.2.1 Duties

The Contractor shall employ, on-site at the project location, a full time Superintendent who shall be subject to approval by the Government prior to Notice to proceed being given. The Superintendent shall devote his time exclusively to the supervision of work under this contract only and shall be on-site at least on normal working days between the Normal hours of 7:30 a.m. and 4:30 p.m. and at all times during the active performance of construction activities. The Superintendent is not to self-perform work activities. The Superintendent shares a high level of responsibility for management and production of timely and quality conforming work. The Superintendent shall have the authority to act for the Contractor with the same force and effect of the project manager. There may be multiple job sites with work in progress at the same time. The Superintendent shall visit each site a minimum of once a day when work is being performed, supervise and monitor work performance and accurately report activities in daily reports.
Autonomy of the on-site superintendent is critical to the smooth operation of FLETC requirements.

The QC Management organization is not subordinate to the Superintendent. An Appointment Letter delegating these authorities shall be signed by a Principle Officer of the firm and submitted to the COR along with the Superintendent's resume for approval. The Superintendent is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meeting, and conduct Progress Meetings. The Superintendent will conduct frequent and routine meetings with Contractor and Subcontractor personnel to: coordinate trade work performance, review schedule objectives for definable features of work, coordinate work conformance to approved submittals, plan and sequence the orderly progress of trade work, correct work deficiencies, maintain job site safety, address material and equipment delivery and proper storage, ensure environmental compliance, ensure testing is satisfactorily, and conduct other related supervisory duties as necessary. The Superintendent may be designated as the safety competent person as defined by the adopted U.S. Army Corps of Engineers (USACE) Safety Manual EM 385-1-1. Computer proficiency is required in such software systems as Word, Excel, Outlook (e-mail) and MS Project/Primavera. The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling.

1.6.2.2 Superintendent Qualifications

An individual with a minimum of fifteen (10) years combined experience in the following positions: Project Superintendent, QC Manager, Project Manager, or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract

The individual shall have at least five (5) years of experience as a Superintendent on similar size, complexity and type contracts. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail).

The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.2.3 Alternate Superintendent Duties and Qualifications

The Government approved and authorized alternate Superintendent shall be available on-site to serve in the event of the designated primary Superintendent’s absence. The Alternate Superintendent's duties and qualifications shall be the same as the Superintendent's

The individual shall have at least five (5) years of experience as a Superintendent on similar size, complexity and type contracts. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail).

The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.2.4 Alternate Superintendent Duties and Qualifications

The Government approved and authorized alternate Superintendent shall be available on-site to serve in the event of the designated primary Superintendent's absence. The Alternate Superintendent's duties and qualifications shall be the same as the Superintendent's.

1.6.3 Project Manager

1.6.3.1 Duties

The Contractor shall employ a Project Manager, subject to approval by the Government prior to Notice to Proceed being given. The Project Manager shall devote his time exclusively to this contract and shall be on-site on normal working days at least between the Normal hours of 7:30 a.m. and 4:30 p.m. The PM will be the Government's primary point of contact for this contract. PM is also responsible for day-to-day task order management and administration. The PM is not to self-perform work activities. The PM shares a high level of responsibility for management and production of timely and quality conforming work. The QC Management organization is not subordinate to the PM. The PM shall be delegated authority by the Contractor to sign contract modifications, negotiate and reach agreement for the Contractor on matters such as change orders, time extensions, and other issues arising under the contract which may lead to contract modification in accordance with FAR 52- 236-6. An Appointment Letter delegating these authorities shall be signed by a Principle Officer of the firm and submitted to the Government. An original signature copy of this delegation of authority shall be provided to the Contracting Officer with the Project Manager's resume. The PM is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meetings, and Progress Meetings.

1.6.3.2 PM Qualifications

An individual with a minimum of fifteen (10) years combined experience in the following positions: Project Manager, Project Superintendent, QC Manager, or Construction Manager with the last five (5) years' experience as a Project Manager on specific IDIQ, SABER, or JOC contracts within the minimum range of at $3M or above, with a performance period of

more than one year. The Project Manager must have been employed directly by the prime contractor and served in that capacity for the duration of the contract. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail). The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.3.3 Alternate PM Duties and Qualifications

The Government approved and authorized alternate Project Manager shall be available on-site to serve in the event of the designated primary Project Manager's absence. The Alternate PM's duties and qualifications shall be the same as the Project Manager's.

1.6.4 Key Personnel Resume Requirements

1.6.4.1 Acceptable key personnel qualifications, performance, and organizational observance of required authorities are considered critical to the project.

1.6.4.2 Offeror's shall initially submit their proposed primary and alternate key personnel resumes and letters with the technical proposal during the contract solicitation phase. Submit primary and alternate Key Personnel resumes and letters as described in paragraph 1.3 Key Personnel Resumes, Qualifications, Letters of Commitment, Certificates and Appointment Letters; Any approvals of proposed key personnel are contingent upon the Government's review and approval of key personnel and satisfactory background investigations. Award of a contract does not imply acceptance of the proposed key personnel. Acceptance occurs post-award.

1.6.4.3 Post-award and a minimum of seven (7) calendar days prior to the scheduled Preconstruction Conference, the Contractor shall again submit the documents required by paragraph 1.3 for formal Government review and approval of all key personnel. Submission of resumes failing to demonstrate compliant qualifications will be rejected.

1.6.4.4 Any subsequent proposed change in key personnel requires submission of the resume and other documents for Government review and approval.

1.6.5 Commissioning Authority

1.6.5.1 Duties

If required by a task order, provide a Commissioning Authority (CA) as key

person for the commissioning (Cx) and documentation thereof, who is subordinate to the QC Manager. The CA shall direct and coordinate Cx activities and submit Cx reports to the COR to meet the submittal and reporting requirements of Commissioning. The CA shall coordinate the actions of the QC Specialists, Testing Laboratory personnel, and other inspection and testing personnel required by this Contract for building Cx.

1.6.5.2 Qualifications

The CA must be certified as a commissioning professional by the Association of Energy Engineers (AEE), the Building Commissioning Association (BCA), the National Environmental Balancing Bureau (NEBB). CA resume is required, providing education, experience and management capabilities on at least two similar size and type contracts. The CA may not have been involved with the project design, construction management, or supervision, and must be with a third-party firm that is not on the design team.

1.7 QUALITY CONTROL (QC) PLAN

1.7.1 Construction Quality Control (QC) Plan

1.7.1.1 Requirements

A QC Plan shall be submitted for review and approval a minimum of seven (7) calendar days prior to the scheduled Preconstruction Conference. Provide, for acceptance by the COR, a Construction QC Plan submitted in a three-ring binder that includes a table of contents, with major sections identified with tabs as listed below, with pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing commissioning activities during the construction of the project. The Contractor is responsible to incorporate any review comments into the Final Plan and obtaining Government approval of the Plan prior to start of work activities as described by the paragraph "Acceptance of the Construction Quality Control Plan".

I. QC ORGANIZATION: A chart showing the QC organizational structure.

II. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format as described by the paragraph "Key Personnel Resume Requirements", for each person in the QC organization. Include all supporting documents demonstrating compliance with the stated qualifications to include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "QC Manager Qualifications".

III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

V. APPOINTMENT LETTERS: Letters signed by a principle officer of the firm appointing the PM, QC Manager, Superintendent, Alternate PM, Alternate QCM and Alternate Superintendent describing and delegating the required duties and authorities required in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work which is not in compliance with the Contract. The QC Manager shall issue letters of direction to all other QC personnel outlining their duties, authorities, and responsibilities. Copies of the letters shall be included in the QC Plan.

VI. SUBMITTAL PROCEDURES: Procedures for reviewing, approving, and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.

VII. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs entitled "Accreditation Requirements", as applicable.

VIII. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, document corrective action plans and complete rework items. Include proposed forms to record and track rework items.

IX. DOCUMENTATION PROCEDURES: Include proposed forms and provide copies of the Government furnished QCM and Superintendent daily report forms.

X. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures you will use to ensure the three phases of control are used to manage the quality on this project.

XI. ORGANIZATIONAL MATRIX: A matrix showing organizational structure and hierarchal relationships of key field staff and home office management.

XII. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.

XIII. TRAINING PROCEDURES AND TRAINING LOG: Procedures for coordinating and documenting the training of personnel required by the Contract.

XIV. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

1.8 QC PLAN MEETINGS

The QC Manager will meet with the COR to discuss the QC Plan requirements of this Contract as required.

1.9 COORDINATION AND MUTUAL UNDERSTANDING MEETINGS

After submission of the QC Plan, and prior to the start of construction work, the QCM will meet with the COR to present the QC program required by this Contract. When a new QC Manager is appointed, the coordination and mutual understanding meeting shall be repeated.

1.9.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how three phases of control will be implemented.

a. Waste Management Plan.

b. Indoor Air Quality (IAQ) Management Plan.

c. Procedures for noise and acoustics management.

d. Environmental Protection Plan.

e. Environmental regulatory requirements.

f. Commissioning (Cx) Plan.

1.9.2 Coordination of Activities

Activities included in various sections shall be coordinated to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation. Schedule construction operations with consideration for indoor air quality as specified in the IAQ Management Plan.

1.9.3 Attendees

As a minimum, the Contractor's personnel required to attend shall include PM, Superintendent, and QC Manager. The Contractor shall provide a copy of the signed minutes to all attendees and a copy shall be included in the Final QC Plan.

1.10 QC MEETINGS

After the start of construction, the QC Manager shall conduct routine QC meetings at the field office with the PM, Superintendent, and the subcontractor foremen. The QC Manager shall prepare the minutes of the meeting and provide a copy to the COR within two working days after the meeting. Government personnel may attend these meetings. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work and rework;

c. Review the status of submittals;

d. Review work and testing accomplished since the last meeting;

e. Address rework items identified since the last meeting;

f. Address rework items corrected since the last meeting;

g. Review the work to be accomplished in the next two weeks and documentation required;

h. Resolve QC and production problems (RFI, etc.);

i. Address items that may require revising the QC Plan;

j. Review Accident Prevention Plan (APP);

k. Review environmental requirements and procedures;

l. Review Waste Management Plan;

m. Review IAQ Management Plan;

n. Review Environmental Management Plan;

o. Review the status of training completion; and

p. Review commissioning (Cx) Plan and progress, if applicable.

1.11 DESIGN REVIEW AND DOCUMENTATION

1.11.1 Design Review

If applicable, the CA shall review design documents to verify that each commissioned system meets the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. Fully document review in written report.

1.11.2 Contract Document Review

The CA shall review the Contract documents to verify that each commissioned system is likely to meet the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts.

1.12 THREE PHASES OF CONTROL

The Three Phases of Control shall adequately cover both on-site and off-site work and shall include the following.

1.12.1 Preparatory Phase

Notify the Government PM at least two work days in advance of each preparatory phase meeting. The meeting shall be conducted by the QC Manager and attended by the Project Superintendent and the foreman responsible for the Definable Feature of Work (DFOW). When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman shall attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFOW:

a. Review each paragraph of the applicable specification sections;

b. Review the Contract drawings;

c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders in order to coordinate work and avoid dimensional errors and rework;

d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;

e. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

f. Examine the work area to ensure that the required preliminary work has been completed;

g. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials;

h. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

i. Discuss construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW;

j. Review the Accident Prevention Plan (APP) and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

k. If applicable, review the Commissioning (Cx) Plan and ensure all preliminary work items have been completed and documented.

1.12.2 Initial Phase

Notify the Government PM at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the Project Superintendent, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the

results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each DFOW:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Ensure that testing is performed by the approved laboratory;

d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met; and

e. If applicable, review the Cx Plan and ensure all preparatory work items have been completed and documented.

1.12.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report:

a. Ensure the work is in compliance with Contract requirements;

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed by the approved laboratory;

d. Ensure that rework items are being corrected;

e. Perform safety inspections; and

f. If applicable, review the Cx Plan and ensure all work items, testing, and documentation has been completed.

1.12.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

1.13 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES. Submittals requiring Government approval will be identified by each task order and are to be scheduled and made prior to the acquisition of the material or equipment covered thereby. Submittals not requiring Government approval will be approved by the Quality Control Manager and made available to the Government if requested for information only. All submittals shall be reviewed and certified compliant by the QCM.

1.14 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.14.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.14.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at http://ts.nist.gov/ts/htdocs/210/214/214.htm, the American Association of State Highway and Transportation Officials (AASHTO) program at http://www.transportation.org/aashto/home.nsf/frontpage, International Accreditation Services, Inc. (IAS) at http://www.iasonline.org, U. S. Army Corps of Engineers Materials Testing Center (MTC) at http://www.wes.army.mil/SL/MTC/, the American Association for Laboratory Accreditation (A2LA) program at http://www.a2la.org/, the Washington Association of Building Officials (WABO) at http://www.wabo.org/.

1.14.3 Capability Check

The Government retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.14.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Project Manager immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Within five (5) days of testing, furnish the signed reports, certifications, and other documentation to the Project Manager via the QC Manager and the Daily QC Report. Full payment for work subject to testing is dependent upon successful testing.

1.15 QC CERTIFICATIONS

1.15.1 CQC Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.15.2 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Government attesting that "the work has been completed, inspected, tested and is in compliance with the Contract."

1.16 COMPLETION INSPECTIONS

1.16.1 Punch-Out Inspection

Near the completion of all work on a task order or any increment thereof, established by a completion time stated in the task order, the QC Manager shall self-perform an inspection of the work and develop a "punch list" of items which do not conform to the contract documents. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch-Out Inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. Four copies of the punch list shall be provided to the Government. The QC Manager shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall certify in writing to the Government that Punch-Out work is satisfactorily completed and the facility is ready for the Government "Pre-Final Inspection". Allow a minimum of two (2) working days for Government coordination of the start of Pre-Final Inspection.

1.16.2 Pre-Final Inspection

The Government will perform this inspection to verify that the task order is complete. The Government may terminate Pre-Final Inspection at any time should it be determined the work has not been satisfactorily completed or that previously documented deficiencies remain incomplete. In such an instance the Contractor shall resume and progress Punch-Out work and the QCM shall repeat the Punch-Out Inspection. A Government "Pre-Final Punch List" may be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the Client can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner and shall be accomplished before the task order completion date for the work, or any particular increment thereof, if the project is divided into increments by separate completion dates.

1.16.3 Final Acceptance Inspection

The QCM shall coordinate with the Government PM the date a task order final acceptance inspection can be held. The notice shall certify in writing that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the proposed date of the final acceptance inspection. The Contractor shall be represented by the QC Manager, Superintendent, the CA if applicable, and

others deemed necessary. Attendees for the Government may include the Project Manager, COR, and personnel representing the Client.

1.17 TRAINING

Prior to request for "Pre-final Inspection" of a task order by the QC Manager, provide Government personnel training for the systems and equipment if specified by a task order. The trainees shall include the Government's Project Manager, ConRep, facilities managers, maintenance staff, and key building occupants. The Contractor shall be responsible for coordinating, scheduling, and ensuring that training is completed. Instructors shall have a working knowledge and be well-versed in the particular systems that they are presenting. Provide instruction time on site at a location approved by the Government Project Manager.

1.17.1 Content

Training shall stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The core of this training will be based on manufacturer's recommendations and the operation and maintenance information provided as a part of this Contract. A review of environmentally-related aspects of the Operation and Maintenance Manuals shall be included. The following shall be included for each system:

a. Design intent based on the contract documents.

b. Use of O&M Manuals.

c. Review of control drawings and schematics.

d. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

e. Interactions with other systems.

f. Adjustments and optimizing methods for energy conservation.

g. Relevant health and safety issues.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

j. Discussion of how the feature or system is environmentally responsive.

1.17.2 Building Systems Training

The QCM shall be responsible for coordination of all building systems training with the Government. Prior to Punch-Out of a task order, provide the Government Project Manager a comprehensive listing of the building systems training and the proposed training schedule for each course. Training course schedules are subject to Government coordination and

approval. The Contractor will provide each trainee in the course a written course outline and training manual, listing the major and minor topics to be discussed by the instructor on each day of the course. Assume a maximum of ten (10) trainees in any single system course of training. The QCM shall record training minutes and a sign-in list containing attendees' names/organizations. Submit to the Government Project Manager a record of training agendas, minutes, and attendees within five (5) calendar days of completion of each training course.

1.18 DOCUMENTATION

1.18.1 Construction Documentation

Reports are required for each day that work is performed and shall accompany the Contractor Quality Control Daily Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign their respective daily reports. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.18.2 Quality Control Field Office Library

Establish and maintain the following library of information at the site Contractor field office in a series of separate three ring binders. Binders shall be identified, divided and tabbed for the orderly presentation of information. These binders shall be maintained, readily and publicly accessible in the field office to Government personnel during all business hours.

a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.

b. All milestone inspections.

c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.

d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

e. An up-to-date copy of the Rework Items List and the related Corrective Action Plans.

f. Maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the Government.

g. Commissioning documentation including Cx checklists, schedules, tests, and reports.

h. Training Log, training agendas, attendees list, training manuals, training verification forms and other supporting documentation.

i. Copies of Field Change and Variance Logs arranged numerically in a chronological order recording all Government approved field changes and variances. Use the Government approved form for Variances. Include description of the subject specification or drawing reference, related correspondence and documents, and documentation of Field Change or Variance approval from the Project Manager.

j. Testing Plan and Log including all test reports and approvals organized and tabbed by specification section.

k. Request For Information (RFI) Log including copies of all RFI's and the responses arranged in a numerical order.

l. Submittal Log including a comprehensive listing of all submittals required by the contract documents with delivery dates and actions taken. Organize and tab by specification section.

m. Contractor Construction Compliance Notice (CCCN) Log including copies of all original signed compliance notices arranged in numerical order. Include descriptions of problems, corrective actions, and dates of correction completion.

o. Listing of all Subcontractors and emergency contact information for each.

1.18.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Government Project Manager. Attach a copy of the updated "Testing Plan and Log" to the Daily CQC Report.

1.18.4 Rework Items List and Corrective Action Plans

The QC Manager shall maintain a list of work that does not comply, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. Provide detailed written Corrective Action Plans to the Government Project Manager as requested in association with rework items. Corrective action plans shall be presented in narrative format with supporting drawings, product information, submittals, and other documents as required. Do not progress work without written Government Project Manager approval of Corrective Action Plans. Make changes to Corrective Action Plans as required by the Government. Remove and replace non-compliant or deficient work as instructed. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to each Progress Meeting Agenda and to the last daily

CQC Report of each month. The Contractor shall be responsible for including those items identified by the Government.

1.18.5 As-Built Drawings

The QC Manager is required to ensure the as-built drawings, if required, are kept current on a daily basis and marked to show deviations which have been made from the task order drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. Field Change No., Variance No., Modification No., Request for Information No., etc.). The QC Manager shall initial each revision.

1.19 NOTIFICATION OF NON-COMPLIANCE

The Government will notify the Contractor of detected non-compliance with the Contract. Such notice, when verbally delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. The Government may, at its discretion, issue Construction Contractor Compliance Notices (CNNN's) or other written documentation concerning a non-complaint work. The Contractor shall take immediate steps to bring work into compliance. When a Corrective Action Plan is required by the Government, no corrective work shall occur prior to Government Project Manager approval of the Corrective Action Plan. If the Contractor fails or refuses to promptly bring work into compliance, the Government may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time for excess costs or damages by the Contractor.

1.20 CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

An IAQ Management Plan shall be submitted not less than 10 days before the Preconstruction Conference. Revise and resubmit Plan as required by the Government. Copies of the final Plan shall be made available to all workers on site. Include provisions in the Plan to meet the requirements specified below and to ensure safe, healthy air for construction workers and building occupants.

1.20.1 Requirements During Construction

Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D 6245. Provide for evaluation of volatile organic compounds (VOCs) in indoor air in accordance with ASTM D 6345. Use filters with a Minimum Efficiency Reporting Value (MERV) of 8 in permanently installed air handlers during construction.

1.20.1.1 Control Measures

The Contractor shall meet or exceed the requirements of SMACNA 1507, Chapter 3, to help minimize contamination of the building from construction activities. The five requirements of this manual which must be adhered to are described below:

a. HVAC protection: Isolate return side of HVAC system from surrounding environment to prevent construction dust and debris from entering the duct work and spaces.

b. Source control: Use low emitting paints and other finishes, sealants, adhesives, and other materials as specified. When available, cleaning products shall have a low VOC content and be non-toxic to minimize building contamination. Utilize cleaning techniques that minimize dust generation. Cycle equipment off when not needed. Prohibit idling motor vehicles where emissions could be drawn into building. Designate receiving/storage areas for incoming material that minimize IAQ impacts.

c. Pathway interruption: When pollutants are generated use strategies such as 100 percent outside air ventilation or erection of physical barriers between work and non-work areas to prevent contamination.

d. Housekeeping: Clean daily to remove construction dust and debris. Promptly clean up spills. Remove accumulated water and keep work areas dry to discourage the growth of mold and bacteria. Take extra measures when hazardous materials are involved.

e. Scheduling: Control the sequence of construction to minimize the absorption of VOCs by other building materials.

1.20.1.2 Moisture Contamination

a. Remove accumulated water and keep work dry.

b. Use dehumidification to remove moist, humid air from a work area.

c. Do not use combustion heaters or generators inside the building.

d. Protect porous materials from exposure to moisture.

e. Remove from the site and replace water damaged items as directed by the Project Manager.

1.20.2 Requirements After Construction

After construction ends, replace HVAC filtration media.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

3.2 GOVERNMENT QUALITY ASSURANCE

In accordance with FAR 52.246-12, Inspection of Construction:

a. Government inspections and tests are for the sole benefit of the Government and do not-

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;
(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;
(3) Constitute or imply acceptance; or
(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

b. The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the task order specification.

c. The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Project Manager. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work.

d. The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

e. If the Contractor does not promptly replace or correct rejected work, the Government may-

(1) By contract or otherwise, replace or correct the work and charge the cost to the Contractor; or
(2) Terminate for default the Contractor's right to proceed.

f. If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Government shall make an equitable adjustment for the additional services involved in the examination and

reconstruction, including, if completion of the work was thereby delayed, an extension of time.

3.3 GOVERNMENT ACCEPTANCE

The performance and quality of work delivered by the Contractor, including services rendered and any documentation, shall be subject to inspection, review, and acceptance by the Government. All work shall be completed within the time specified in the contract, including provision of close-out documents and correction of deficiencies noted during the final inspection.

3.4 WARRANTY RESPONSIBILITIES

The Contractor shall perform quality control duties in relation to warranty work. Provide a knowledgeable and competent person on site to coordinate, supervise, and to execute quality control processes on warranty work. Perform final inspection of warranty work and promptly notify the Government of the compliant completion of warranty work. Responses times and corrective actions shall be coordinated with the Government. In accordance with FAR 52.246-21 Warranty of Construction:

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under each task order conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of 1 year from the date of final acceptance of the work in each task order. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of-

(1) The Contractor's failure to conform to contract requirements; or
(2) Any defect of equipment, material, workmanship, or design furnished.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

e. The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government

shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall-

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

h. This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2007) Standard for Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2009) Standard for Safeguarding Construction,Alteration, and Demolition Operations
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation. Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

Backflow preventers; G

Construction Site Plan; G

SD-02 Shop Drawings

Traffic control plan; G

SD-06 Test Reports

Backflow Preventer Tests; G

SD-07 Certificates

Backflow Tester Certification; G

Backflow Preventers Certificate of Full Approval

1.4 TEMPORARY UTILITIES

1.4.1 Description of Work

Furnish, install and maintain temporary utilities required for construction. Remove on completion of work.

1.4.1.1 Requirements of Regulatory Agencies

Comply with:

a. National Electrical Code.

b. Federal, State and local codes and regulations.

c. FLETC Utility requirements

1.4.2 Materials

May be new or used, but must be adequate in capacity for the required usage. Must not create unsafe conditions. Must not violate requirements of applicable codes and standards.

1.4.2.1 Temporary Electricity

Temporary power will be extended from Government's existing power system. The Contractor will make all extensions and bear all related costs including the temporary pole and its placement. The temporary pole placement must be coordinated with Georgia Power and the Government. If the Contractor requires a temporary power drop from Georgia Power, he shall arrange for service and bear all related costs.

1.4.2.2 Temporary Telephone Service

Arrange with local telephone service company. Provide direct line telephone service at the construction site for the use of personnel and employees. Service required shall include one direct line instrument in field office and other instruments at the option of the Contractor. Pay all costs for installation, maintenance, and removal and service charges.

1.4.2.3 Temporary Water

Coordinate with the utility owner and make connections to the existing water system. The Contractor will obtain permits, pay for all temporary extensions and bear all related costs.

1.4.2.4 Temporary Toilet Facilities

Provide sanitary facilities in compliance with laws and regulations of the State of Georgia and County of Glynn. Service, clean, and maintain facilities and enclosures.

1.4.3 Installation

Comply with applicable requirements specified in Division 22 and 23 - Plumbing and Mechanical and in Division 26 - Electrical. Maintain and operate systems to ensure continuous service. Modify and extend service systems as work progress requires.

1.5 WEATHER PROTECTION

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

1.5.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

1.5.1.1 Hurricane Condition of Readiness

Unless directed otherwise, comply with:

a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards. Contact COTR for Condition Requirements.

b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment.Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness. Contact COTR for weather and COR updates and completion of required actions.

c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours):Curtail or cease routine activities until securing operation is complete.Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact COTR for weather and Condition of Readiness (COR) updates and completion of required actions.

d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

1.6 STATION OPERATION AFFECT ON CONTRACTOR OPERATIONS

1.6.1 Restricted Access Areas

The Government will monitor work in areas indicated. Notify Contracting Officer at least 14 calendar days prior to starting work in these areas.

1.6.2 Special Restrictions Regarding Access of Vehicles and Parking

1.6.2.1 Interruption of Vehicular Traffic

If during the performance of work, it becomes necessary to modify vehicular traffic patterns at any locations, notify the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan shall be in accordance with State and local regulations. Provide cones, signs, barricades, lights, signal men, or other traffic control devices and personnel required to control traffic. During construction, all traffic interruptions must be scheduled to minimize affects on staff and students. To minimize interruptions to staff and students, at the discretion of the Government, the closures may be required to occur during nonworking hours and/or weekends. Overtime and/or weekend work shall be at the expense of the Contractor.

1.7 STORAGE AREAS

Contractor shall be responsible for security of his property. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

1.7.1 Storage Size and Location

The open site available for storage shall be as indicated.

1.7.2 Storage in Existing Buildings

The Contractor shall be working around existing buildings; the storage of material will be allowed where indicated. Provide 8 foot high security fence with a lockable gate around the storage area. Remove at the completion of work and return existing facilities to their original condition.

1.8 TEMPORARY SANITARY FACILITIES

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required and approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance. Coordinate with the utility provider as required and dispose of sewage through connection to a municipal, district, or station sanitary sewage system. Bear all related costs of sanitary connections and facilities. Where such systems are not available, use chemical toilets or comparably effective units, and

periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Include provisions for pest control and elimination of odors.

1.9 TEMPORARY BUILDINGS

Temporary facilities (including trailers) shall be in like new condition. Locate these facilities where directed and within the indicated operations area. Storage of material/debris under such facilities is prohibited. Contractor shall be responsible for the security of the stored property.

1.9.1 Trailers or Storage Buildings

Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Government.The trailers or buildings shall be in good condition, free from visible damage rust and deterioration, and meet all applicable safety requirements. Trailers shall be roadworthy and comply with all appropriate state and local vehicle requirements. Failure to maintain storage trailers or buildings to these standards shall result in the removal of non-complying units at the Contractor's expense. A sign not smaller than 24 by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state of local standards for anchoring mobile trailers.

PART 2 PRODUCTS

2.1 BACKFLOW PREVENTERS

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound flanged cast iron, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. Approved backflow preventers shall be installed at all temporary connections to public fire hydrants.

PART 3 EXECUTION

3.1 TEMPORARY PHYSICAL CONTROLS

3.1.1 Access Controls

3.1.1.1 Temporary Barricades

Contractor shall provide for barricading around all work areas to prevent public access.

3.1.1.2 Fencing

The fencing shall be chain link and be 8 feet in height and be placed around the perimeter of the construction site and laydown area, and likewise a plastic silt fence shall be placed around construction site and laydown area. Fencing shall be provided along the construction site at all open excavations and tunnels controlling access to unauthorized people.

Fencing must be installed to be able to restrain a force of at least 200 pounds against it.

In addition, prior to the start of work, enclose those areas at the construction site which are not within the construction fence with a temporary safety fence, including gates and warning signs, to protect the public from construction activities. The safety fence shall be made of high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on minimum 10 foot centers. Remove the fence from the work site and restore to original condition upon completion of the contract.

3.1.1.3 Safety Signs

Place warning signs at the construction area perimeter designating the presence of construction hazards requiring unauthorized persons to keep out. Signs must be placed on all sides of the project, with at least one sign every 300 feet. All points of entry shall have signs designating the construction site as a hard hat area. Erect signs upon start of construction work.

3.2 TEMPORARY WIRING

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Program shall include frequent inspection of all equipment and apparatus.

3.3 CONSTRUCTION SIGN

Provide a 4 feet by 8 feet marine grade plywood project construction sign as described by the drawings in this section. Include project information on the sign and locate the sign as instructed by the PM. Erect project sign within 15 days of Notice to Proceed. Remove and dispose upon project completion.

-- End of Section --

SECTION 01 52 50

SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Requirements of this Section apply to, and are component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.14	(1991) Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.94	Ventilation
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.502(f)	Warning Line Systems

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	(2003) Safety and Health Requirements Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2004) Safeguarding Construction,Alteration, and Demolition Operations

1.3 DEFINITIONS

a. Multi-employer work site (MEWS). The prime contractor is the "controlling authority" for all work site safety and health of the subcontractors.

b. Recordable Occupational Injuries or Illness. An occupational injury or illnesses which result in serious injuries, lost workday cases, non-fatal cases or significant mishaps.

c. Serious Injuries & Fatalities. Regardless of the time between the injury and death or the length of the illness; hospitalization of three or more employees; or property damage in excess of $200,000.

d. Lost Workday Cases. Injuries, other than fatalities, that result in lost workdays.

e. Non-Fatal Cases. Cases without lost workdays which result in transfer to another job or termination of employment, or require medical treatment (other than first aid) or involve property damage in excess of $10,000 but less than $200,000 or involve: loss of consciousness or restriction of work or motion. This category also includes any diagnosed occupational illnesses which are reported to the employer but are not classified as facilities or lost workday cases.

f. Health and Safety Plan. Army term of SHP or SSHP used in COE EM-385-1-1. "USACE" property and equipment specified in COE EM-385-1-1 should be interpreted as Government property and equipment.

g. Safety Officer. The superintendent or other qualified or competent person who is responsible for the on-site safety required for the project. The Contractor Quality Control Manager cannot be the safety officer, even through the QC has safety inspection responsibilities as part of the QC duties.

h. Significant Contractor Mishap. A contractor mishap which involves falls of 4 feet or more, electrical mishaps, confined space mishaps, diving mishaps, equipment mishaps, and fire mishaps which result in a lost time injury, or property damage of $10,000 or more, but less than $200,000; or when fire department or emergency medical treatment (EMT) assistance is required.

i. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment provided by a physician or registered personnel.

j. First Aid. A one-time treatment, and follow-up visit for the purpose of observation, of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care, even though provided by a physician or registered professional personnel.

k. Lost Workdays. The number of days (consecutive or not) after, but not including, the day of injury or illness during which the employee would have worked but could not do so; that is, could not perform all or part of his normal assignment during all or any part of the workday or shift; because of the occupational injury or illness.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00, "Submittal Procedures."

SD-07 Certificates

Accident prevention plan (APP);

Health and Safety Plan;

The above must be submitted a minimum of 7 days prior to scheduled Preconstruction Conference. Government approval is required prior to Notice to Proceed and commencement of construction work activities.

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

a. Qualifications of Safety Officer:

(1) Ability to manage the on-site contractor safety program through appropriate management controls,

(2) Ability to identify hazards and have the capability to expend resources necessary to abate the hazards.

(3) Must have worked on similar types of projects that are equal to or exceed the scope of the project assigned with the same responsibilities.

b. Qualification of Crane Operators. Crane operators shall meet the requirements in COE EM-385-1-1, Appendix G.

1.5.2 Meetings

1.5.2.1 Preconstruction Conference

The safety officer shall attend the preconstruction conference and routine progress meetings.

1.5.2.2 Meeting on Work Procedures

Meet with employees regularly to discuss work procedures and safety precautions required by the APP and AHA. Ensure the participation of the Contractor's PM, Superintendent and the Quality Control Manager.

1.6 ACCIDENT PREVENTION PLAN (APP)

Prepare the APP in accordance with the required and advisory provisions of COE EM-385-1-1 including Appendix A, "Minimum Basic Outline for Preparation of Accident Prevention Plan," and as modified herein. Include the associated AHA and other specific plans, programs and procedures listed on Pages A-3 and A-4 of COE EM-385-1-1, some of which are called out below. On-site work shall not be authorized until the Government has approved the APP.

1.6.1 Contents of the Accident Prevention Plan

a. Name and safety related qualifications of Safety Officer (including training and any certifications).

b. Qualifications of competent and of qualified persons including competent person for excavation.

c. Identify of the individual who will complete exposure data (hours worked); accident investigations, reports and logs; and immediate notification of accidents to include subcontractors.

d. Emergency response plan. Conform to COE EM-385-1-1, paragraph 01.E and include a map denoting the route to the nearest emergency care facility with emergency phone numbers. Contractor may be required to demonstrate emergency response.

e. Hazardous Material Use. Provisions to deal with hazardous materials, pursuant to the Contract Clause "FAR 52.223-3, Hazardous Material Identification and Material Safety Data." And the following:

(1) Inventory of hazardous materials to be introduced to the site with estimated quantities.

(2) Plan for protecting personnel and property during the transport, storage and use of the materials

(3) Emergency procedures for spill response and disposal, including a site map with approximate quantities on site at any given time. The site map will be attached to the inventory, showing where the hazardous substances are stored

(4) Safety Data Sheets for inventoried materials not required in other section of this specification.

(5) Labeling system to identify contents on all containers on-site.

(6) Plan for communicating high health hazards to employees and adjacent occupants.

f. Hazardous Energy Control Plan. For hazardous energy sources, comply with COE EM-385-1-1, paragraph 12.A.07.

g. Critical Lift Procedures. Weight handling critical lift plans will be prepared and signed in accordance with COE EM-385-1-1, paragraph 16.c.18.

h. Alcohol and Drug Abuse Plan. Description of the on-site prevention program.

i. Fall Protection Plan. The plan shall be site specific and protect all workers at elevations above 6 feet.

j. Silica Exposure Reduction. The plan shall include specific procedures to prevent employee silica inhalation exposures.

k. Excavation Plan. The safety and health aspects prepared in accordance with Section 02302, "Excavation, Backfilling, and Compacting for Utilities"

1.7 ACTIVITY HAZARD ANALYSIS (AHA)

Prepare for each task order. As a minimum, define activity being performed, sequence of work, specific hazards anticipated, control measures to eliminate or reduce each hazard to acceptable levels, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall arrest systems. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include excavation safeguarding requirements. The appropriate AHA shall be reviewed and attendance documented by Contractor at the preparatory, initial, and follow-up phases of Quality Control inspection.

1.8 HEALTH AND SAFETY PLAN (HASP)

Prepare as required by 29 CFR 1910.120 and COE EM-385-1-1.

1.8.1 Contents

a. Location, size, and details of control areas.

b. Location and details of decontamination systems.

c. Interface of trades involved in the construction.

d. Sequencing of work.

e. Disposal plan.

f. Sampling protocols.

g. Testing labs.

h. Protective equipment.

i. Pollution control.

j. Evidence of compliance with 29 CFR 1910.120 and 29 CFR 1926.65.

k. Training and certifications of CIH, CSP or other competent persons.

1.9 FALL HAZARD PREVENTION PROGRAM

1.9.1 Scaffolds

Delineate the fall protection requirements necessary during the erection and dismantling operation of scaffolds used on the project in the fall protection plan and activity hazard analysis for the phase of work.

1.9.2 Training

Institute a fall protection program. As part of the Fall Protection Program, contractor shall provide training for each employee who might be exposed to fall hazards.

1.10 DUTIES OF THE SAFETY OFFICER

a. Actively participate in the development of the required safety plan submittals.

b. Monitor and ensure construction hazards are identified and corrected.

c. Maintain applicable safety reference material, including COE EM-385-1-1, on the job site.

d. Maintain a log of safety inspections performed. Report all observed safety violations and corrective actions in writing to the Government.

e. Immediately stop any work activity in the event unsafe work practices are observed which are believed to pose a serious risk to personnel safety or property.

f. Attend the pre-construction conference and routine progress meetings.

g. Provide regular safety related training and instruction to all employees performing work under this contract.

1.11 DISPLAY OF SAFETY INFORMATION

Display the following information in clear view of the on-site construction personnel:

a. Map denoting the route to the nearest emergency care facility with emergency phone numbers.

b. AHA

c. Confined space entry permit.

d. Sign with number of hours worked since last lost workday accident.

1.12 SITE SAFETY PREFERENCE MATERIALS

Maintain safety-related references applicable to the project on site, including COE EM-385-1-1 and those others listed in the article "References." Maintain applicable equipment manufacturers' manuals.

1.13 HIGH HAZARD WORK AND LONG DURATION

Work under this contract is potentially hazardous. Pursuant to contract clause "FAR 52.236-13, Accident Prevention, Alternate I," submit in writing additional proposals for effecting accident prevention under hazardous conditions.

1.14 SITE CONDITIONS

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide.

1.15 REPORTS

1.15.1 Reporting Reports

For OSHA inspections or recordable accidents, the prime contractor will conduct a suitable investigation, provide a copy of the OSHA inspection or accident report to the Government, and identify corrective actions. Provide findings and reports to the Government within 5 calendar days of the inspection or accident.

1.15.2 Notification

Notify the Contracting Officer, within 4 hours, of any accident meeting the definition of OSHA recordable occupational injury or illness. Information shall include Contractor name; contract title; type of contract; name of activity, installation or location where mishap occurred; date and time of mishap; names of personnel injured; extent of property damage, if any; and brief description of mishap (to include type of construction equipment used, PPE used, etc.) In addition to OSHA reporting requirements, initial notification shall be made of any accident involving significant mishaps.

1.15.3 OSHA Citations and Violations

Provide the PM and Contracting Officer with a copy of each OSHA citation, OSHA report and Contractor response. Correct violations and citations promptly and provide written corrective actions to the Government.

PART 2 PRODUCTS

2.1 FALL PROTECTION ANCHORAGE

Fall protection anchorages, used by contractors to protect their people, will be left in place and so identified for continued customer use.

PART 3 EXECUTION

3.1 CONSTRUCTION

Comply with COE EM-385-1-1, NFPA 241, the accident prevention plan, the activity hazard analysis and other related submittals and activity fire and safety regulations.

3.1.1 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited.

3.1.2 Unforeseen Hazardous Material

The task order should have identified materials such as PCB, lead paint, and friable and nonfriable asbestos. If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer, ConRep and COR immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or

poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages a minimum of 15 days in advance. As a minimum, the request should include the location of the outage, utilities being effected, duration of outage and any necessary sketches. Once approved and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Construction Representative to review the scope of work and the lock out/tag out procedures for worker protection.

3.3 PERSONNEL PROTECTION

3.3.1 Hazardous Noise

Provide hazardous noise signs, and hearing protection, where ever equipment and work procedures produce sound-pressure levels greater than 85 dBA steady state or 140 dBA impulse, regardless of the duration of the exposure.

3.3.2 Fall Protection

Enforce use of the fall protection device named for each activity in the AHA all times when an employee is on a surface 6 feet or more above lower levels. Personal fall arrest systems are required when working from an articulating or extendible boom, scissor lifts, swing stages, or suspended platform. Fall protection must comply with ANSI A10.14.

3.3.2.1 Personal Fall Arrest Device

Equipment, subsystems, and components shall meet ANSI Z359.1, Personal Fall Arrest Systems. Only an full-body harness with a shock absorbing lanyard is an acceptable personal fall arrest device. Body belts may only be used as positioning devices only such as for steel reinforcing assembly. Body belts are not authorized as a personal fall arrest device. Harnesses must have upper middle back "D" rings for proper body suspension during a fall. Lanyard must be fitted with a double locking snap hook attachment. Webbing, straps, and ropes must be of synthetic fiber or wire rope.

3.3.2.2 Fall Protection for Roofs

a. For work within 6 feet of an edge, on low pitched roofs, personnel shall be protected by use of personal fall arrest systems, guardrails, safety nets. Safety monitoring system is not adequate fall protection and is not authorized.

b. For work greater than 6 feet from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.502(f).

c. Work on steep roofs requires personal fall arrest, guardrails with toeboards, or safety nets. This requirement includes residential or housing type construction.

3.3.2.3 Safety Nets

Safety nets shall be provided in unguarded workplaces over water, machinery, dangerous operations, or more than 25 feet above surface.

3.3.3 Scaffolding

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Contractor shall ensure that scaffold erection is performed by employees that are qualified. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection plan. Minimum platform size shall be based on the platform not being greater in height than four times the dimension of the smallest width dimension for rolling scaffold. Some Baker type scaffolding has been found not to meet these requirements. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. The first tie-in shall be at the height equal to 4 times the width of the scaffold base.

3.3.4 Use of Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufactures printed operating instructions. Crane supported work platforms shall only be used in extreme conditions if the Contractor proves that using any other access to the work location would provide a greater hazard to the workers.

b. Cranes must be equipped with Load Indicating Devices, anti-two blocks devices, load, boom angle moment indicating indicators.

c. Christmas-tree lifting (multiple rigged materials) is not allowed.

3.3.5 Excavations

The Safety Officer shall be on site when work is being performed in excavation, and shall inspect excavations prior to entry by workers. Individual must evaluate for all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

3.3.6 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cable intended to be cut must be positively identified and de-energized prior to performing each cut. Perform all high voltage cutting remotely. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high

voltage personnel must use personnel protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor AHA.

3.3.7 Crystalline Silica

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and COE EM-385-1-1, (Appendix C). The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.4 ACCIDENT SCENE PRESERVATION

For serious accidents, ensure the accident site is secured and evidence is protected remaining undisturbed until released by the Contracting Officer.

3.5 FIELD QUALITY CONTROL

3.5.1 Inspection

Include safety inspection as a part of the daily Quality Control inspections required in Section 01 45 00, "Quality Control."

-- End of Section --

SECTION 01 57 19.00 20

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004	(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)
EPA 833-R-060-04	(2000) Developing Your Storm Water Pollution Prevention Plan, a Guide for Construction Sites

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 271	Requirements for Authorization of State Hazardous Waste Programs
40 CFR 272	Approved State Hazardous Waste Management Programs
40 CFR 273	Standards For Universal Waste Management
40 CFR 279	Standards for the Management of Used Oil
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 355	Emergency Planning and Notification
40 CFR 372-SUBPART D	Specific Toxic Chemical Listings
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Garbage, refuse, debris, sludge, or other discharged material, including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations. Types of solid waste typically generated at construction sites may include:

a. Green waste: The vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

b. Surplus soil: Existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included.

c. Debris: Non-hazardous solid material generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

d. Wood: Dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated and/or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included.

e. Scrap metal: Scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

f. Paint cans: Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.

g. Recyclables: Materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company. Paint cans may be included as recyclable if sold to a scrap metal company.

h. Hazardous Waste: By definition, to be a hazardous waste a material must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste.They have

additional regulatory controls and must be handled separately. They are thus defined separately in this document.

Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.3 Hazardous Debris

As defined in Solid Waste paragraph, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) per 40 CFR 261; or debris that exhibits a characteristic of hazardous waste per 40 CFR 261.

1.2.4 Chemical Wastes

This includes salts, acids, alkalizes, herbicides, pesticides, and organic chemicals.

1.2.5 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.6 Hazardous Waste

Any discarded material, liquid, solid, or gas, which meets the definition of hazardous material or is designated hazardous waste by the Environmental Protection Agency or State Hazardous Control Authority as defined in 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 271, 40 CFR 272, 40 CFR 273, 40 CFR 279, and 40 CFR 280.

1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that:

a. Is regulated as a hazardous material per 49 CFR 173, or

b. Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.120, or

c. During end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical

waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.8 Waste Hazardous Material (WHM)

Any waste material which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial hazard to human health or the environment and which has been so designated. Used oil not containing any hazardous waste, as defined above, falls under this definition.

1.2.9 Oily Waste

Those materials which are, or were, mixed with used oil and have become separated from that used oil. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, used oil and may be appropriately tested and discarded in a manner which is in compliance with other State and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that:

a. It is not prohibited in other State regulations or local ordinances

b. The amount generated is "de minimus" (a small amount)

c. It is the result of minor leaks or spills resulting from normal process operations

d. All free-flowing oil has been removed to the practical extent possible

Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, a hazardous waste determination must be performed prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.10 Regulated Waste

Those solid waste that have specific additional Federal, state, or local controls for handling, storage, or disposal.

1.2.11 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

chlorofluorocarbon-11 (CFC-11)
chlorofluorocarbon-12 (CFC-12)
chlorofluorocarbon-13 (CFC-13)
chlorofluorocarbon-111 (CFC-111)

chlorofluorocarbon-112 (CFC-112)
chlorofluorocarbon-113 (CFC-113)
chlorofluorocarbon-114 (CFC-114)
chlorofluorocarbon-115 (CFC-115)
chlorofluorocarbon-211 (CFC-211)
chlorofluorocarbon-212 (CFC-212)
chlorofluorocarbon-213 (CFC-213)
chlorofluorocarbon-214 (CFC-214)
chlorofluorocarbon-215 (CFC-215)
chlorofluorocarbon-216 (CFC-216)
chlorofluorocarbon-217 (CFC-217)
chlorofluorocarbon-500 (CFC-500)
chlorofluorocarbon-502 (CFC-502)
chlorofluorocarbon-503 (CFC-503)
halon-1211
halon-1301
halon-2402
carbon tetrachloride
methyl bromide
methyl chloroform

Class II ODS is defined in Section 602(s) of The Clean Air Act and includes the following chemicals:

hydrochlorofluorocarbon-21 (HCFC-21)
hydrochlorofluorocarbon-22 (HCFC-22)
hydrochlorofluorocarbon-31 (HCFC-31)
hydrochlorofluorocarbon-121 (HCFC-121)
hydrochlorofluorocarbon-122 (HCFC-122)
hydrochlorofluorocarbon-123 (HCFC-123)
hydrochlorofluorocarbon-124 (HCFC-124)
hydrochlorofluorocarbon-131 (HCFC-131)
hydrochlorofluorocarbon-132 (HCFC-132)
hydrochlorofluorocarbon-133 (HCFC-133)
hydrochlorofluorocarbon-141 (HCFC-141)
hydrochlorofluorocarbon-142 (HCFC-142)
hydrochlorofluorocarbon-221 (HCFC-221)
hydrochlorofluorocarbon-222 (HCFC-222)
hydrochlorofluorocarbon-223 (HCFC-223)
hydrochlorofluorocarbon-224 (HCFC-224)
hydrochlorofluorocarbon-225 (HCFC-225)
hydrochlorofluorocarbon-226 (HCFC-226)
hydrochlorofluorocarbon-231 (HCFC-231)
hydrochlorofluorocarbon-232 (HCFC-232)
hydrochlorofluorocarbon-233 (HCFC-233)
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hydrochlorofluorocarbon-241 (HCFC-241)
hydrochlorofluorocarbon-242 (HCFC-242)
hydrochlorofluorocarbon-243 (HCFC-243)
hydrochlorofluorocarbon-244 (HCFC-244)
hydrochlorofluorocarbon-251 (HCFC-251)
hydrochlorofluorocarbon-252 (HCFC-252)
hydrochlorofluorocarbon-253 (HCFC-253)
hydrochlorofluorocarbon-261 (HCFC-261)
hydrochlorofluorocarbon-262 (HCFC-262)
hydrochlorofluorocarbon-271 (HCFC-271)

1.2.11.1 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (e.g., thermostats) and lamps (e.g., fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey;

Solid Waste Management Plan and Permit;

Regulatory Notifications;

Environmental Management Plan;

Storm Water Pollution Prevention Plan;

Storm Water Notice of Intent (for NPDES coverage under the general permit for construction activities);

Dirt and Dust Control Plan

Contractor Hazardous Material Inventory Log;

SD-06 Test Reports

Laboratory Analysis

Disposal Requirements

Erosion and Sediment Control Inspection Reports

Storm Water Inspection Reports for General Permit

Contractor 40 CFR employee training records Solid

Waste Management Report;

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with

Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

The Contractor may be required to promptly conduct tests and procedures for the purpose of assessing whether construction operations are in compliance with Applicable Environmental Laws. Analytical work shall be done by qualified laboratories; and where required by law, the laboratories shall be certified.

1.4.1 Environmental Compliance Assessment Training and Tracking System (ECATTS)

The Superintendent is responsible for environmental compliance on task orders unless an Environmental Manager is named. The Superintendent (and alternative Superintendent) or Environmental Manager shall complete ECATTS training prior to starting respective portions of on-site work under this contract. If personnel changes occur for any of these positions after starting work, replacement personnel shall complete ECATTS training within 14 days of assignment to the contract.

Submit an ECATTS certificate of completion for personnel who have completed the required "Environmental Compliance Assessment Training and Tracking System (ECATTS)" training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

This training has been structured to allow contractor personnel to receive credit under this contract and also to carry forward credit to future contracts. Contractors shall ensure that the QC Manager (and alternate QC Manager) or Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific State regulatory requirements; therefore, Contractors working in multiple states will be requires to re-take modules tailored to the state where the contract work is being performed.

ECATTS is available for use by all contractor and subcontractor personnel associated with this project. These other personnel are encouraged (but not required) to take the training and may do so at their discretion.

1.4.2 Conformance with the Environmental Management System

The Contractor shall perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to objectives and targets, environmental programs and operational controls identified by the EMS. The Contractor will provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, the Contractor shall take corrective and/or preventative actions. In addition, the Contractor shall ensure that its employees are aware of their roles and responsibilities under the EMS and how these EMS roles and responsibilities affect work performed under the contract.

The Contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and keep up to date on regulatory required specific training for the type of work to be conducted onsite. All on-site Contractor personnel, and their subcontractor personnel, performing tasks that have the potential to cause a significant environmental impact shall be competent on the basis of appropriate education, training or experience. Upon contract award, the Contracting Officer's Representative will notify the installation's EMS coordinator to arrange EMS training. The installation's EMS coordinator shall identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. The Contractor shall provide training documentation to the Contracting Officer. The EMS coordinator shall retain associated records.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey

Perform a Preconstruction Survey of task order sites, and take photographs showing existing environmental conditions in and adjacent to the site.

1.5.2 Regulatory Notifications

The Contractor is responsible for all regulatory notification requirements in accordance with Federal, State and local regulations. The Contractor shall submit copies of all regulatory notifications to the Contracting Officer prior to commencement of work activities.

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting.

Prior to initiating any work on site, meet with the PM to develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, required permits, permit requirements, and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager will be directly responsible for coordinating contractor compliance with Federal, State, local, and station requirements. The Environmental Manager will ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the Environmental Management Plan; ensure that all environmental permits are obtained, maintained, and closed out; ensure compliance with Storm Water Program Management requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral duty of the Superintendent; however the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure all Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder

and required documentation, including environmental permits compliance and close-out.

1.5.5 Contractor 40 CFR Employee Training Records

Prepare and maintain employee training records throughout the term of the contract meeting applicable 40 CFR requirements. The Contractor will ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with Federal, State and local regulatory requirements for RCRA Large Quantity Generator. The Contractor will provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ENVIRONMENTAL MANAGEMENT PLAN

Prior to initiating any work on site, the Contractor will meet with the Contracting Officer to discuss the proposed Environmental Protection Plan and develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. The Contractor's Environmental Plan shall incorporate construction related objectives and targets from the installation's Environmental Management System. The Environmental Management Plan will be submitted in the following format and shall include the elements specified below.

a.Description of the Environmental Management Plan

(1) General overview and purpose

(a) A brief description of each specific plan required by environmental permit or elsewhere in this contract.

(b) The duties and level of authority assigned to the person(s) on the job site that oversee environmental compliance.

(c) A copy of any standard or project specific operating procedures that will be used to effectively manage and protect the environment on the project site.

(d) Communication and training procedures that will be used to convey environmental management requirements to contractor employees and subcontractors.

(e) Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

(2) General site information

(3) A letter signed by an officer of the firm appointing the Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract.

b. Management of Natural Resources

(1) Land resources

(2) Tree protection

(3) Replacement of damaged landscape features

(4) Temporary construction

(5) Stream crossings

(6) Fish and wildlife resources

(7) Wetland areas

c. Protection of Historical and Archaeological Resources

(1) Objectives

(2) Methods

d. Storm Water Management and Control

(1) Ground cover

(2) Erodible soils

(3) Temporary measures

(a) Mechanical retardation and control of runoff

(b) Vegetation and mulch

(4) Effective selection, implementation and maintenance of Best Management Practices (BMPs).

e. Protection of the Environment from Waste Derived from Contractor Operations

(1) Control and disposal of solid and sanitary waste.

(2) Control and disposal of hazardous waste (Hazardous Waste Management Section)

This item will consist of the management procedures for all hazardous waste to be generated. The elements of those procedures will coincide with the Activity Hazardous Waste Management Plan. A copy of the Activity Hazardous Waste Management Plan will be provided by the Contracting Officer. As a minimum, include the following:

(a) Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated;

(b) Sampling/analysis plan;

(c) Methods of hazardous waste accumulation/storage (i.e., in tanks and/or containers);

(d) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted);

(e) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268);

(f) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and the like;

(g) Used oil management procedures in accordance with 40 CFR 279;

(h) Pollution prevention\hazardous waste minimization procedures;

(i) Plans for the disposal of hazardous waste by permitted facilities;

(j) Procedures to be employed to ensure all required employee training records are maintained.

f. Prevention of Releases to the Environment

(1) Procedures to prevent releases to the environment

(2) Notifications in the event of a release to the environment

g. Regulatory Notification and Permits

List what notifications and permit applications must be made. Demonstrate that those permits have been obtained by including copies of all applicable, environmental permits.

3.1.1 Environmental Protection Plan Review

Within thirty days after the Contract award date, submit the proposed Environmental Management Plan for further discussion, review, and approval. Commencement of work will not begin until the environmental management plan has been approved.

3.1.2 Licenses and Permits

Obtain licenses and permits pursuant to the "Permits and Responsibilities" FAR Clause 52.236-7.

No permits will be obtained by the Contracting Officer.

3.2 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. If the work is near streams, lakes, or other waterways, conform to the national permitting requirements of the Clean Water Act.

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor will be responsible for any resultant damage.

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

3.2.1 Erosion and Sediment Control Measures

3.2.1.1 Burnoff

Burnoff of the ground cover is not permitted.

3.2.1.2 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.2.1.3 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

a. Mechanical Retardation and Control of Runoff

Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.

b. Sediment Basins

(1) Trap sediment in temporary sediment basins. Select a basin size to accommodate the runoff of a local 5-year storm. Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs.

(2) Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare BMP Inspection Reports as required by the general permit. If required by the permit, include those inspection reports.

c. Vegetation and Mulch

(1) Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

(2) Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish or reestablish a suitable stand of grass. The seeding operation will be as specified in Section 32 92 19 SEEDING.

3.2.2 Erosion and Sediment Control Inspection Reports

Submit "Erosion and Sediment Control Inspection Reports" (E&S) (form provided at the pre-construction conference) and Storm Water Inspection Reports for General Permit for General Permit to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch or more of rain.

Note erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports if applicable.

3.2.2.1 Storm Water Notice of Intent for Construction Activities and Storm Water Pollution Prevention Plan

The Contractor shall submit a Storm Water Notice of Intent (for NPDES coverage under the general permit for construction activities) and a Storm Water Pollution Prevention Plan (SWPPP) for the contract to the Contracting Officer prior and gain approval prior to the commencement of work. The SWPPP will meet the requirements of the EPA or State general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate Federal or State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. The Contractor shall maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, reflecting current site conditions.

Coverage under this permit requires the contractor prepare a Storm Water Pollution Prevention Plan (SWPPP), prepare and submit a Registration

Statement as a co-permittee with the CO, and provide the permit fee to the responsible state agency before any land disturbing activities begin. The contractor shall file for permit coverage on behalf CO and himself and file a Notice of Termination once construction is complete and the site is stabilized with a final sustainable cover.

Under the terms and conditions of the permit, the Contractor may be required to install, inspect, maintain best management practices (BMPs), and submit stormwater BMP inspection reports and stormwater pollution prevention plan inspection reports. The Contractor shall ensure construction operations and management are constantly in compliance with the terms and conditions of the general permit for storm water discharges from construction activities.

a. The SWPPP shall:

(1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

(2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

(3) Ensure compliance with terms of the EPA or State general permit for storm water discharge.

(4) Select applicable best management practices from EPA 833-R-060-04.

(5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

(6) Storm Water Pollution Prevention Measures and Notice of Intent 40 CFR 122.26, EPA 833-R-060-04. Provide a "Storm Water Pollution Prevention Plan" (SWPPP) for the project. The SWPPP will meet the requirements of the EPA or State general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate Federal or State agency for approval, a minimum of 14 calendar days prior to the start of construction. A copy of the approved SWPPP will be kept at the construction on-site office, and continually updated as regulations require reflecting current site conditions.

3.2.2.2 Storm Water Pollution Prevention Plan Compliance Notebook

The contractor shall create and maintain a binder of documents that demonstrate compliance with the Stormwater Construction Activity permit.

3.2.3 Stormwater Drainage and Construction Dewatering

There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to the river without prior specific authorization of the Environmental Division in writing. Discharge of hazardous substances will not be permitted under any circumstances.

Construction site runoff will be prevented from entering any storm drain or the river directly by the use of straw bales or other method suitable to the Environmental Division. Contractor will provide erosion protection of the surrounding soils.

Construction Dewatering shall not be discharged to the sanitary sewer. If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Authorization for any contaminated groundwater release shall be obtained in advance from the base Environmental Officer. Discharge of hazardous substances will not be permitted under any circumstances.

3.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Upon discovery, notify the Contracting Officer. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.4 SOLID WASTE MANAGEMENT PLAN AND PERMIT

Provide to the contracting officer written notification of the quantity of solid waste/debris that is anticipated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance or as applicable, submit one copy of a State and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

3.4.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

The Contractor will include copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, the Contractor may submit a statement indicating the disposal location for the solid waste which is signed by an officer of the Contractor firm authorized to legally obligate or bind the firm. The sales documentation or Contractor certification will include the receiver's tax identification number and business, EPA or State registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained by the Contractor for his own use, the Contractor will submit on the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.4.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged and can be coordinated with the Contracting Officer and the activity recycling coordinator. Remove all solid waste (including non-hazardous debris) from Government property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage spent hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, as per environmental law.

3.4.2.1 Dumpsters

Equip dumpsters with a secure cover and paint the standard base color. Keep cover closed at all times, except when being loaded with trash and debris. Empty site dumpsters as needed to keep the site free of debris and trash. For large demolitions, large dumpsters without lids are acceptable but should not have debris higher than the sides before emptying.

3.5 WASTE DETERMINATION DOCUMENTATION

Complete a Waste Determination form (provided at the pre-construction conference) for all contractor derived wastes to be generated. Base the waste determination upon either a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated, EPA approved analytical data, or laboratory analysis (Material Safety Data Sheets (MSDS) by themselves are not adequate). Attach all support documentation to the Waste Determination form. As a minimum, a Waste Determination form must be provided for the following wastes (this listing is not all inclusive): oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and all containers of the original materials.

3.6 CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG

Submit the "Contractor Hazardous Material Inventory Log"(found at: http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.6.1 Disposal Documentation for Hazardous and Regulated Waste

Manifest, pack, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of construction in accordance with the generating facilities generator status under the Recourse Conservation and Recovery Act. Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or State permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifest must be reviewed, signed, and approved before the Contractor may ship waste. To obtain specific disposal instructions the Contractor must coordinate with the environmental office.

3.7 POLLUTION PREVENTION/HAZARDOUS WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of hazardous waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the Environmental Management Plan. Consult with the activity Environmental Office for suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for reference material when preparing this part of the plan. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the types of the hazardous materials expected to be used in the construction when requesting information.

3.8 WHM/HW MATERIALS PROHIBITION

No waste hazardous material or hazardous waste shall be disposed of on government property. No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract. The government is not responsible for disposal of Contractor's waste material brought on the job site and not required in the performance of this contract. The intent of this provision is to dispose of that waste identified as waste hazardous material/hazardous waste as defined herein that was generated as part of this contract and existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. Incidental materials used to support the contract including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive. The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or to the river or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

3.9 HAZARDOUS MATERIAL MANAGEMENT

No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract.

Include hazardous material control procedures in the Safety Plan. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Submit a MSDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on base. Typical materials requiring MSDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of

hazardous materials have NFPA labels or their equivalent. Keep copies of the MSDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project. Certify that all hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste per 40 CFR 261.

3.10 PETROLEUM PRODUCTS AND REFUELING

Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed of at Contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

3.10.1 Oily and Hazardous Substances

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

3.10.2 Inadvertent Discovery of Petroleum Contaminated Soil or Hazardous Wastes

If petroleum contaminated soil or suspected hazardous waste is found during construction that was not identified in the contract documents, the contractor shall immediately notify the contracting officer. The contractor shall not disturb this material until authorized by the contracting officer.

3.11 FUEL TANKS

Petroleum products and lubricants required to sustain up to 30 days of construction activity may be kept on site. Storage and refilling practices shall comply with 40 CFR Part 112. Secondary containment shall be provided and be no less than 110 percent of the tank volume plus five inches of free-board. If a secondary berm is used for containment then the berm shall be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Drips pans are required and the tanks must be covered during inclement weather.

3.12 RELEASES/SPILLS OF OIL AND HAZARDOUS SUBSTANCES

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Contracting Officer.

The Contractor is responsible for verbal and written notifications as required by the federal 40 CFR 355, State, local regulations and Homeland Security Instructions. Spill response will be in accordance with 40 CFR 300 and applicable State and local regulations. Contain and clean up these spills without cost to the Government. If Government assistance is requested or required, the Contractor will reimburse the Government for such assistance. Provide copies of the written notification and documentation that a verbal notification was made within 20 days.

Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous (WHM) waste spills. The Contractor shall reimburse the government for all material, equipment, and clothing generated during any spill cleanup. The Contractor shall reimburse the government for all costs incurred including sample analysis materials, equipment, and labor if the government must initiate its own spill cleanup procedures, for Contractor responsible spills, when:

a. The Contractor has not begun spill cleanup procedure within one hour of spill discovery/occurrence, or

b. If, in the government's judgment, the Contractor's spill cleanup is not adequately abating life threatening situation and/or is a threat to any body of water or environmentally sensitive areas.

3.13 CONTROL AND MANAGEMENT OF HAZARDOUS WASTES

3.13.1 Facility Hazardous Waste Generator Status

FLETC is designated as a Large Quantity Generator. All work conducted within the boundaries of this activity must meet the regulatory requirements of this generator designation. The Contractor will comply with all provisions of Federal, State and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of all construction derived wastes.

3.13.2 Hazardous Waste/Debris Management

Identify all construction activities which will generate hazardous waste/debris. Provide a documented waste determination for all resultant waste streams. Hazardous waste/debris will be identified, labeled, handled, stored, and disposed of in accordance with all Federal, State, and local regulations including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the Environmental Protection Plan. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government.

Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by activity personnel from the Environmental Office. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-

SUBPART D. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.13.2.1 Regulated Waste Storage/Satellite Accumulation/90 Day Storage Areas

If the work requires the temporary storage/collection of regulated or hazardous wastes, the Contractor will request the establishment of a Regulated Waste Storage Area, a Satellite Accumulation Area, or a 90 Day Storage Area at the point of generation. The Contractor must submit a request in writing to the Contracting Officer providing the following information:

Contract Number	_____	Contractor	_____
Haz/Waste or Regulated Waste POC	_____	Phone Number	_____
Type of Waste	_____	Source of Waste	_____
Emergency POC	_____	Phone Number	_____

Location of the Site: _____
(Attach Site Plan to the Request)

Attach a waste determination form. Allow ten working days for processing this request. The designated area where waste is being stored shall be barricaded and a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.13.2.2 Sampling and Analysis of HW

a. Waste Sampling

Sample waste in accordance with EPA 530/F-93/004. Each sampled drum or container will be clearly marked with the Contractor's identification number and cross referenced to the chemical analysis performed.

b. Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. The Contractor will provide all analytical results and reports performed to the Contracting Officer

c. Analysis Type

Identify waste hazardous material/hazardous waste by analyzing for the following properties as a minimum: ignitability, corrosiveness, total chlorides, BTU value, PCBs, TCLP for heavy metals, and cyanide.

3.13.2.3 Asbestos Certification

Items, components, or materials disturbed by or included in work under this contract do involve asbestos. Other materials in the general area around

where work will be performed may contain asbestos. All thermal insulation, in all work areas, should be considered to be asbestos unless positively identified by conspicuous tags or previous laboratory analysis certifying them as asbestos free.

Inadvertent discovery of non-disclosed asbestos that will result in an abatement action requires a change in scope before proceeding. Upon discovery of asbestos containing material not identified in the contract documents, the Contractor shall immediately stop all work that would generate further damage to the material, evacuate the asbestos exposed area, and notify the Contracting Officer for resolution of the situation prior to resuming normal work activities in the affected area. The Contractor will not remove or perform work on any asbestos containing materials without the prior approval of the Contracting Officer. The Contractor will not engage in any activity, which would remove or damage such materials or cause the generation of fibers from such materials.

Asbestos containing waste shall be managed and disposed of in accordance with applicable environmental law. Asbestos containing waste shall be manifested and the manifest provided to the Contracting Officer.

3.13.2.4 Hazardous Waste Disposal

No hazardous, toxic, or universal waste shall be disposed or hazardous material abandoned on government property. And unless otherwise noted in this contract, the government is not responsible for disposal of Contractor generated waste material. The disposal of incidental materials used to accomplish the work including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive.

The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or water way or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

Control of stored waste, packaging, sampling, analysis, and disposal will be determined by the details in the contract. The requirements for jobs in the following paragraphs will be used as the guidelines for disposal of any hazardous waste generated.

a. Responsibilities for Contractor's Disposal

Contractor responsibilities include any generation of WHM/HW requiring Contractor disposal of solid waste or liquid.

(1) The Contractor agrees to provide all service necessary for the final treatment/disposal of the hazardous material/waste in accordance with all local, State and Federal laws and regulations, and the terms and conditions of the contract within sixty (60) days after the materials have been generated. These services will include all necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal, and/or transportation, including manifesting or completing waste profile sheets, equipment, and the compilation of all documentation is required).

(2) Contain all waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 272, 40 CFR 273, 40 CFR 279, 40 CFR 280, and 40 CFR 761.

(3) Obtaining a representative sample of the material generated for each job done to provide waste stream determination.

(4) Analyzing for each sample taken and providing analytical results to the Contracting Officer. Provide two copies of the results.

(5) Determine the DOT proper shipping names for all waste (each container requiring disposal) and will demonstrate how this determination is developed and supported by the sampling and analysis requirements contained herein to the Contracting Officer.

Contractor Disposal Turn-In Requirements

For any waste hazardous materials or hazardous waste generated which requires the Contractor to dispose of, the following conditions must be complied with in order to be acceptable for disposal:

a. Drums compatible with waste contents and drums meet DOT requirements for 49 CFR 173 for transportation of materials.

b. Drums banded to wooden pallets. No more than three (3) 55 gallon drums to a pallet, or two (2) 85 gallon over packs.

c. Band using 1-1/4 inch minimum band on upper third of drum.

d. Recovery materials label (provided by Code 106.321) located in middle of drum, filled out to indicate actual volume of material, name of material manufacturer, other vendor information as available.

e. Always have three (3) to five (5) inches of empty space above volume of material. This space is called 'outage'.

3.13.3 Class I and II ODS Prohibition

Class I ODS as defined and identified herein will not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition will be considered to prevail over any other provision, specification, drawing, or referenced documents. Regulations related to the protection of stratosphere ozone may be found in 40 CFR 82.

Heating and air conditioning technicians must be certified through an EPA-approved program. Copies of certifications shall be maintained at the employees' place of business and be carried as a wallet card by the technician, as provided by environmental law. Accidental venting of a refrigerant is a release and shall be reported to the Contracting Officer.

3.13.3.1 Universal Waste/e-Waste Management

Universal waste including but not limited to some mercury containing building products such florescent lamps, mercury vapor lamps, high pressure sodium lamps, CRTs, batteries, aerosol paint containers, electrical equipment containing PCBs, and consumed electronic devices, shall be managed

in accordance with applicable environmental law and installation instructions.

3.14 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.14.1 Dirt and Dust Control Plan

Submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

3.15 ABRASIVE BLASTING

3.15.1 Blasting Operations

The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive, agent, paint chips, and other debris in accordance with the requirements specified. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.15.2 Disposal Requirements

Submit analytical results of the debris generated from abrasive blasting operations per paragraph entitled Laboratory Analysis of this section. Hazardous waste generated from blasting operations will be managed in accordance with paragraph entitled "Hazardous Waste\Debris Management" of this section and with the approved HWMP. Disposal of non-hazardous abrasive blasting debris will be in accordance with paragraph entitled, "Control and Disposal of Solid Wastes".

3.16 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated times.

3.17 MERCURY MATERIALS

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the Environmental Office and the

Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal.

-- End of Section --

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4439	(2004) Geosynthetics
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 SYSTEM DESCRIPTION

The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies in conformance with the requirements of the National Pollutant Discharge Elimination System (NPDES).

1.3 EROSION AND SEDIMENT CONTROLS

The controls and measures required of the Contractor are described below.

1.3.1 Stabilization Practices

The stabilization practices to be implemented include temporary seeding, mulching, geotextiles, and protection of trees. On the daily CQC Report, record the dates when the major grading activities occur, (e.g., clearing and grubbing, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS, initiate stabilization practices as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.3.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases or is precluded by unsuitable conditions caused by the weather, initiate stabilization practices as soon as practicable after conditions become suitable.

1.3.1.2 Burnoff

Burnoff of the ground cover is not permitted.

1.3.1.3 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified, and protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

1.3.2 Erosion, Sediment and Stormwater Control

a. Submit a Storm Water Notice of Intent for NPDES coverage under the general permit for construction activities and a Storm Water Pollution Prevention Plan (SWPPP) for the project to the Contracting Officer prior to the commencement of work. The SWPPP shall meet the requirements of the State of Georgia general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. Maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, toreflect current site conditions. Include within the SWPPP:

(1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

(2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

(3) Ensure compliance with terms of the State of Georgia general permit for storm water discharge.

(4) Select applicable best management practices from EPA 832-R-92-005.

(5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

1.3.3 Structural Practices

Implement structural practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement structural practices in a timely manner, during the construction process, to minimize erosion and sediment runoff. Include the following devices; Location and details of installation and construction are shown on the drawings.

1.3.3.1 Silt Fences

Provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Properly install silt fences to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Install silt fences in the locations indicated on the drawings. Obtain approval from the Contracting Officer prior to final removal of silt fence barriers.

1.3.4 Vegetation and Mulch

a. Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

b. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to reestablish a suitable stand of grass. The seeding operation will be as specified in Section 32 92 19 SEEDING.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Storm Water Pollution Prevention Plan

Storm Water Notice of Intent

Pollution prevention plan and Notice of intent for NPDES coverage under the general permit for construction activities

SD-06 Test Reports

Erosion and Sediment Controls

SD-07 Certificates

Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

Identify, store and handle filter fabric in accordance with ASTM D4873.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

Provide geotextile that complies with the requirements of ASTM D4439, and consists of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and contains stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Provide synthetic filter fabric that contains ultraviolet ray inhibitors and stabilizers to assure a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE		
PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile Elongation (percent)	ASTM D4632	445 N100 lbs. min. 30 percent max.
Trapezoid Tear	ASTM D4533	245 N min.55 lbs. min.
Permittivity	ASTM D4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D4751	20-100

2.1.2 Silt Fence Stakes and Posts

Use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 by 2 inches when oak is used and 4 by 4 inches when pine is used, and have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

Provide a mill certificate or affidavit attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. Specify in the mill certificate or affidavit the actual Minimum Average Roll Values and identify the fabric supplied by roll identification numbers. Submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Extend silt fences a minimum of 24 inches above the ground surface without exceeding 34 inches above the ground surface. Provide filter fabric from a

continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, splice together filter fabric at a support post, with a minimum 8 inch overlap, and securely sealed. Excavate trench approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Remove silt fences upon approval by the Contracting Officer.

3.2 FIELD QUALITY CONTROL

Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

3.2.1 Silt Fence Maintenance

Inspect the silt fences in accordance with paragraph, titled "Inspections," of this section. Any required repairs shall be made promptly. Pay close attention to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, replace the fabric promptly. Remove sediment deposits when deposits reach one-third of the height of the barrier. Remove a silt fence when it is no longer required. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall receive erosion control.

3.3 INSPECTIONS

3.3.1 General

Inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit a site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Conduct inspections at least once every month where sites have been finally stabilized.

3.3.2 Inspections Details

Inspect disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system. Observe erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan to ensure that they are operating correctly. Inspect discharge locations or points to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Inspect locations where vehicles exit the site for evidence of offsite sediment tracking.

3.3.3 Inspection Reports

For each inspection conducted, prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection,

the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. Furnish the report to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 1971	(2005) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2000; R 2009) Industrial and Institutional Cleaners

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08	(2009, with Change 1) Criteria for Transfer and Acceptance of DoD Real Property

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials
Warranty
Final Cleaning

SD-08 Manufacturer's Instructions

Preventative Maintenance
Inspection
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

Drawings showing final as-built conditions of the task order. This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions.

1.3.1.1 Not used

1.3.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes.

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

g. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications

1.3.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract

set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate.

1.4 MECHANICAL TESTING AND BALANCING

All contract requirements of Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC must be fully completed, including all testing, prior to contract completion date. In addition, all contract requirements of Section 23 05 93 TESTING, ADJUSTING AND BALANCING must be fully completed, including testing and inspection, prior to contract completion date

1.5 OPERATION AND MAINTENANCE MANUALS

Submit two copies of the project operation and maintenance manuals.

1.5.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data are to be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.5.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the task order provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services.

1.6 CLEANUP

Provide final cleaning in accordance with ASTM E 1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and remove construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport off site and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on site.

Submit documentation for all materials removed from FLETC (e.g. recyclables, solid waste, etc.). Submit disposal/recycling tickets and truck transportation tickets for all material loads removed from FLETC. All transportation and landfill tickets shall bear the original signatures, load weights, and name of disposal/recycling facility. Provide for proper chain-of-custody for all materials, project site to disposal/recycling site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 81 19

INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 008	(2007) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SUMMARY

Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out after construction, pre-occupancy.

1.3 DESCRIPTION, GENERAL

a. IAQ Management During Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:

1. Practices which minimize the amount of dust generated.

2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.

3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.

4. No visible haze in the air.

b. IAQ Management Plan Before Occupancy: Minimize indoor pollutant concentrations to required levels prior to Owner occupancy.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction IAQ Management Plan During Construction;

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN DURING CONSTRUCTION

a. General IAQ Plan requirements during construction include:

1. Compliance with ANSI/SMACNA 008 "SMACNA Guidelines for Occupied Buildings Under Construction."

2. Provide solid physical barriers to isolate areas of construction. Securely attach and seal at floor and structure above.

3. Schedule adequate time for product installation.

4. Maintain negative pressure in construction area.

5. Do not recirculate air prior to occupancy.

6. Seal return air ducts and use direct exhaust to outside.

7. Factory age sheet goods.

8. Comply with manufacturer's instructions for appropriate drying times.

9. Protect installed absorbent materials with recycled or recyclable materials.

b. The IAQ Plan shall meet or exceed the five SMACNA requirements and shall include the following measures:

1. HVAC Protection.

2. Source Control.

3. Pathway Interruption.

4. Housekeeping.

5. Scheduling.

c. HVAC Protection:

1. Protect air handling and distribution equipment, and air supply and return ducting during construction.

2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.

3. Apply protection immediately after installation of equipment and ducting.

4. Ducting runs that require more than a single day to install shall be protected at the end of each day's Work.

5. During dust producing activities, (e.g., drywall installation and finishing), turn the ventilation system off, and protect HVAC supply and return openings from dust infiltration. Provide temporary ventilation as required.

6. If the air handling system is used during construction, MERV 8 filtration media is required on all air handling units, and return air grills or any open vents. The filter media needs to be maintained and replaced before occupancy or if it becomes clogged with debris.

d. Source Control:

1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.

2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.

3. Preconditioning:

a) Prior to delivery to the construction site allow products that have odors and significant volatile organic compound (VOC) emissions to off-gas in dry, well ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions.

b) Condition products, without containers and packaging, to maximize off-gassing of VOCs.

c) Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period.

d) Do not ventilate within limits of Work unless otherwise accepted by Contracting Officer.

e) Comply with substitution requirements for consideration of other locations.

4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.

5. Replace moldy materials with new, undamaged materials.

6. Provide sufficient ventilation, air circulation and air changes to dissipate excess humidity when present.

e. Pathway Interruption:

1. All openings within the designated work area shall be sealed.

2. Adequate exhaust ventilation equipment shall be installed to maintain a negative pressure differential between the work area and adjacent areas of the building.

3. Ventilation units shall be exhausted to the outside of the building.

f. Housekeeping:

1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.

2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:

a) Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is stated in these Specifications, a period of 72 hours shall be used.

b) Ventilate areas directly to outside, do not ventilate to other enclosed spaces.

c) If continuous ventilation is not possible via the building's HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.

3. Suppress dust with wetting agents or sweeping compounds.

4. Clean-up dust using a wet rag or damp mop.

5. Increase the cleaning frequency when dust build-up is noted.

6. Remove spills or excess applications of solvent-containing products as soon as possible.

7. Remove accumulated water and keep work areas as dry as possible.

8. Store volatile liquid containers closed when the container is inside of the building and not in use.

9. Keep volatile liquid containers closed when the container is inside of the building and not in use.

10. HEPA vacuuming and duct cleaning:

a) Vacuum carpeted and soft surfaces with a high efficiency particulate arrestor (HEPA) vacuum.

b) If ducts contain dust and dirt, clean them using a HEPA vacuum immediately before substantial completion and prior to using the ducts to circulate air.

c) Oil film on sheet metal should be removed before shipment to site. However, ducts will be inspected to confirm that no oil film is present. Remove any oil.

11. Use nontoxic cleaning materials and procedures:

a) Alternatives to toxic cleaning agents include:

1) Vinegar.

2) Citrus.

3) Borax.

4) Cornstarch.

5) Baking soda.

b) Examples of nontoxic alternatives for several cleaning methods are listed below:

1) Abrasive cleaners: Substitute half lemon dipped in borax.

2) Ammonia cleaners: Substitute vinegar, salt, and water mixture; or baking soda and water.

3) Disinfectants: Substitute half cup borax in a gallon of water.

4) Drain cleaners: Substitute one fourth cup baking soda and one fourth cup vinegar in boiling water.

5) Upholstery cleaners: Substitute dry cornstarch.

g. Scheduling:

1. Where odorous and/or high VOC-emitting products are applied on site, apply them before installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.

2. Insure that wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are properly and fully cured before installing other finish materials over them.

3. Install carpets and furnishings after all other interior finish materials have been applied and fully cured.

4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.

-- End of Section --

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance with ACI MCP PACK Parts 2 and 3.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI MCP PACK	(2011) Manual of Concrete Practice

ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615/A615M	(2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C 330	(2005) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C1064/C1064M	(2008) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C143/C143M	(2010a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2010b) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2010) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2011) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2008a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2011b) Standard Specification for Ready-Mixed Concrete
ASTM D1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.3 SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in

accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples for strength tests not less than once each shift in which concrete is produced from each class of concrete required. Provide a minimum of three specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, and one will be tested at 7 days for information.

1.3.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'c, and no individual acceptance test result falls below f'c by more than 500 psi.

1.3.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed.Surface requirements for the classes of finish required are as specified in Part 4 of ACI MCP PACK.

1.3.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. Specified compressive strength f'c shall be 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 1 inch, in accordance with ACI MCP PACK Part 3. The air content shall be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water cement ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Water-Reducing or Retarding Admixture
Curing Materials
Expansion Joint Filler Strips, PremoldedJoint Sealants - Field Molded Sealants

Conveying and Placing Concrete
Formwork
Forms
Ready-Mix Concrete
Mix Design Data;
Fly Ash
Accessories, Curing Compound

SD-06 Test Reports

Aggregates
Concrete Mixture Proportions
Compressive Strength Testing
Slump

SD-07 Certificates

Cementitious Materials
Aggregates
Bill of Lading

1.5 QUALITY ASSURANCE

Indicate specific locations of Steel Reinforcement on installation drawings and include, but not be limited to, square feet of concrete placements, thicknesses and widths, plan dimensions, and arrangement of cast-in-place concrete section.

PART 2 PRODUCTS

2.1 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.1.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.1.1.1 Portland Cement

ASTM C150/C150M, Type I.

2.1.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class C or F, including requirements of Tables 1A and 2A.

2.1.2 Aggregates

Fine and coarse aggregates shall meet the quality and grading requirements of ASTM C33/C33M Class Designations 4M or better. Perform evaluation of fine and coarse aggregates separately and in combination, matching the proposed mix design proportioning. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

Aggregates for lightweight concrete shall meet ASTM C 330.

2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed.

2.1.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.1.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

2.1.4 Water

Use fresh, clean, potable water for mixing and curing, free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60. Welded steel wire fabric shall conform to the requirements of ASTM A185/A185M. Details of reinforcement not shown shall be in accordance with ACI MCP PACK Part 3, Chapters 7 and 12.

2.1.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded shall be sponge rubber conforming to ASTM D1752, Type I.

2.1.7 Joint Sealants - Field Molded Sealants

Joint sealants - field molded sealants shall conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

2.1.8 Formwork

The design and engineering of the formwork as well as its construction, will be the responsibility of the Contractor.

2.1.9 Form Coatings

Coat forms, for exposed surfaces, with a nonstaining form oil to be applied shortly before concrete is placed.

2.1.10 Curing Materials

Provide curing materials conforming to the following requirements.

2.1.10.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C171, type optional, except polyethylene film, if used, shall be white opaque.

2.1.10.2 Membrane-Forming Curing Compound

ASTM C309, Type 1-D or 2, Class A.

2.2 READY-MIX CONCRETE

a. Concrete shall be ready-mix concrete with mix design data conforming to ACI MCP PACK Part 2. Bill of Lading for each ready-mix concrete delivery shall be in accordance with ASTM C94/C94M.

b. Non-exposed concrete elements: 3000 psi minimum compressive strength.

c. Slump: 1 to 4 inch according to ASTM C143/C143M and ACI MCP PACK Part 1.

d. Portland Cement conforming to ASTM C150/C150M, Type I or II.

e. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

f. Air-Entraining Admixtures conforming to ASTM C260/C260M. Exterior concrete exposed to freezing needs to be air-entrained 4.5 to 7.5 percent by volume. Nonair-entrained interior concrete shall have a total air content of 2 to 4 percent by volume.

g. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C494/C494M.

h. Fly Ash used as an admixture shall conform to ASTM C618, Class C or F with 4 percent maximum loss on ignition and 35 percent maximum cement replacement by weight. Submit documentation in compliance with 40 CFR 247.

2.3 STEEL REINFORCEMENT

2.3.1 Deformed Steel Bars

Provide steel bars conforming to ASTM A615/A615M, Grade .60 ksi ACI MCP PACK Parts 2 and 3.

2.3.2 Welded Wire Fabric

Provide welded wire fabric conforming to ASTM A185/A185M.

2.4 FORMS

Forms shall be of wood, steel, or other approved material and conform to ACI MCP PACK, Parts 2 and 3.

Provide form release conforming to ACI MCP PACK, Part 4.

2.5 ACCESSORIES

2.5.1 Curing Compound

Provide curing compound conforming to ASTM C309.

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface shall be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Earth foundations shall be satisfactorily compacted. Ensure spare vibrators are available. The entire preparation shall be accepted by the Government prior to placing.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

3.1.2 Formwork Installation

Forms shall be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

3.1.3 Production of Concrete

3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

3.2 CONVEYING AND PLACING CONCRETE

Concrete placement is not permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, deliver the concrete to the site of the work completing the discharge within 1-1/2 hours. Convey concrete from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Deposit concrete as close as possible to its final position in the forms and regulate it so that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. Carry on the placement at such a rate that the formation of cold joints will be prevented. Submit Methods and equipment for transporting, handling, depositing, and consolidating the concrete prior to the first concrete placement. Perform conveying and placing concrete in conformance with the following:

3.2.1 Consolidation

Consolidate each layer of concrete by internal vibrating equipment. Systematically accomplish internal vibration by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by approximately 4 inches. Ensure that the vibrator penetrates rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. Hold vibrator stationary until the concrete is consolidated and then withdraw it slowly at the rate of about 3 inches per second.

3.2.2 Cold-Weather Requirements

No concrete is to be mixed or placed when the ambient temperature is below 36 degrees F or if the ambient temperature is below 41 degrees F and falling. Provide suitable covering and other means as approved for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing. Remove and replace concrete damaged by freezing at the expense of the Contractor.

3.2.3 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI MCP PACK Part 2, is expected to exceed 0.2 psf per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures taken as quickly as finishing operations will allow.

3.2.4 Lifts in Concrete

Deposit concrete in horizontal layers not to exceed 24 inches in thickness. Carry on placement at a rate that prevents the formation of cold joints. Place slabs in one lift.

3.3 FORM REMOVAL

Do not remove forms before 24 hours after concrete placement, except as otherwise specifically authorized. Do not remove supporting forms and shoring until the concrete has cured for at least 5 days. When conditions require longer curing periods, forms shall remain in place.

3.4 FINISHING

3.4.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.4.2 Finishing Formed Surfaces

Remove all fins and loose materials, and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured is the same as adjacent concrete.

3.4.3 Finishing Unformed Surfaces

Float finish all unformed surfaces, that are not to be covered by additional concrete or backfill, to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Slope exterior surfaces for drainage unless otherwise shown. Carefully make joints with a jointing tool. Finish unformed surfaces to a tolerance of 3/8 inch for a float finish and 5/16 inch for a trowel finish as determined by a 10 foot straightedge placed on surfaces shown on the drawings to be level or having a constant slope. Do not perform finishing while there is excess moisture or bleeding water on the surface. No water or cement is to be added to the surface during finishing.

3.4.3.1 Float Finish

Provide float finished surfaces, screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete supports a person's weight without deep imprint, complete floating. Floating shall embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.5 CURING AND PROTECTION

Beginning immediately after placement, and continuing for at least 7 days, cure and protect all concrete from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. Provide all materials and equipment needed for adequate curing and protection at the site of the placement prior to the start of concrete placement. Accomplish moisture preservation of moisture for concrete surfaces not in contact with forms by one of the following methods:

a. Continuous sprinkling or ponding.

b. Application of absorptive mats or fabrics kept continuously wet.

c. Application of sand kept continuously wet.

d. Application of impervious sheet material conforming to ASTM C171.

e. Application of membrane-forming curing compound conforming to ASTM C309, Type 1-D, on surfaces permanently exposed to view. Accomplish Type 2 on other surfaces in accordance with manufacturer's instructions.

Accomplish the preservation of moisture for concrete surfaces placed against wooden forms by keeping the forms continuously wet for 7 days. If forms are removed prior to end of the required curing period, use other curing methods for the balance of the curing period. Do not perform protection removal if the temperature of the air in contact with the concrete may drop more than 60 degrees F within a 24 hour period.

3.6 TESTS AND INSPECTIONS

3.6.1 Field Testing Technicians

The individuals who sample and test concrete, as required in this specification, shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.6.2 Inspection Details and Frequency of Testing

3.6.2.1 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.6.2.2 Air Content

Check air content at least once during each shift that concrete is placed for each class of concrete required. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C231/C231M.

3.6.2.3 Slump

Check slump once during each shift that concrete is produced for each class of concrete required. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C143/C143M.

3.6.2.4 Consolidation and Protection

Ensure that the concrete is properly consolidated, finished, protected, and cured.

3.6.3 Action Required

3.6.3.1 Placing

Do not permit placing to begin until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Do not continue placing if any pile is inadequately consolidated.

3.6.3.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.6.3.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

3.6.4 Reports

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within 3 days after the end of each weekly reporting period. See Section 01 45 00.00 10 QUALITY CONTROL.

3.7 FORM WORK

Form work shall conform to ACI MCP PACK Parts 2 through 5.

3.7.1 Preparation of Form Surfaces

Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces for permanently exposed faces shall be smooth, free from irregularities, dents, sags, or holes. Chamfer exposed joints and exposed edges. Arrange internal ties so that when the forms are removed, the form ties are not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structure.

3.7.2 Form Coating

Coat forms, for exposed surfaces, with a nonstaining form release coating applied. Forms for unexposed surfaces may be wetted in lieu of coating immediately before the placing of concrete, except that in freezing weather form release coating shall be used.

3.7.3 Removal of Forms

Remove forms carefully to prevent damage to the concrete. Do not remove forms before the expiration of the minimum time indicated below:

Arches, beams and deck-type slabs	144 hours
Columns and walls (lifts 15 feet and under)	24 hours
Columns and walls (lifts over 15 feet)	48 hours

3.8 STEEL REINFORCING

Reinforcement shall be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.8.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI MCP PACK Parts 2 and 3. Shop details and bending shall be in accordance with ACI MCP PACK Parts 2 and 3.

3.8.2 Splicing

Perform splices in accordance with ACI MCP PACK Parts 2 and 3.

3.8.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.9 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.10 FIELD TESTING

a. Provide samples and test concrete for quality control during placement. Sampling of fresh concrete for testing shall be in accordance with ASTM C172/C172M.

b. Test concrete for compressive strength at 7 and 28 days for each design mix. Concrete test specimens shall conform to ASTM C31/C31M. Perform Compressive strength testing conforming to ASTM C39/C39M.

c. Test Slump at the site of discharge for each design mix in accordance with ASTM C143/C143M.

d. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or test extremely porous aggregates in accordance with ASTM C173/C173M.

e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M.

-- End of Section --

SECTION 04 20 00

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 530/530.1	(2011) Building Code Requirements and Specification for Masonry Structures and Related Commentaries
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A615/A615M	(2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A82/A82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C1019	(2011) Standard Test Method for Sampling and Testing Grout
ASTM C1072	(2010) Standard Test Method for Measurement of Masonry Flexural Bond Strength
ASTM C1142	(1995; R 2007) Standard Specification for Extended Life Mortar for Unit Masonry
ASTM C129	(2011) Standard Specification for Nonloadbearing Concrete Masonry Units

ASTM C144	(2011) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C207	(2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	(2010) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2010) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C593	(2006) Fly Ash and Other Pozzolans for Use with Lime for Soil Stabilization
ASTM C62	(2010) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C641	(2009) Staining Materials in Lightweight Concrete Aggregates
ASTM C652	(2010) Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C67	(2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C780	(2011) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C90	(2011a) Loadbearing Concrete Masonry Units
ASTM C91	(2005) Masonry Cement
ASTM C94/C94M	(2011a) Standard Specification for Ready-Mixed Concrete
ASTM C989	(2010) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D 2240	(2005; R 2010) Standard Test Method for Rubber Property - Durometer Hardness

ASTM D 2287 (1996; R 2010) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2009; Errata First Printing) International Building Code

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Not used

1.2.3 Not used

1.2.4 Design Requirements

1.2.4.1 Unit Strength Method

Compute compressive strength of masonry system "Unit Strength Method", ACI 530/530.1. Submit calculations and certifications of unit and mortar strength.

1.2.4.2 Seismic Requirement

In addition to design requirements of ICC IBC, provide additional seismic reinforcement as detailed on the drawings. The total minimum reinforcing percentage for structural walls shall be 0.20 percent and non-structural walls shall be 0.15 percent. The maximum spacing of reinforcing bars shall be as follows:

Wall Type	Vertical	Horizontal
Structural	24 inches	48 inches
Non-structural	48 inches	80 inches

Bond beams are required at the top of footings, at the bottom and top of openings at roof and floor levels, and at the top of parapet walls.

1.2.4.3 Masonry Strength

Determine masonry strength in accordance with ACI 530/530.1; submit test reports on three prisms as specified in ACI 530/530.1. The cost of testing shall be paid by the Contractor.

1.2.5 Additional Requirements

a. Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Cement
Brick
Insulation
Cold Weather Installation

SD-04 Samples

Brick
Anchors, Ties, and Bar Positioners

SD-05 Design Data

Pre-mixed Mortar
Unit Strength Method

SD-06 Test Reports

Efflorescence Test
Field Testing of Mortar
Field Testing of Grout
Prism tests
Masonry Cement

SD-07 Certificates

Concrete Masonry Units (CMU)

SD-08 Manufacturer's Instructions

Masonry Cement

1.4 QUALITY ASSURANCE

1.4.1 Appearance

Blend all CMU/brick to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable.

1.4.2 Detail Drawings

Submit detail drawings showing bar splice locations. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during

construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66. Submit drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, stored, handled, and protected to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.5.1 Masonry Units

Cover and protect moisture-controlled concrete masonry units and cementitious materials from precipitation. Conform to all handling and storage requirements of ASTM C90. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.5.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.5.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination or segregation.

1.6 PROJECT/SITE CONDITIONS

Conform to ACI 530/530.1 for hot and cold weather masonry erection.

1.6.1 Hot Weather Installation

Take the following precautions if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent or the ambient air temperature exceeds 90 degrees F and the wind velocity is more than 8 mph. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

1.6.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F or temperature of masonry units is below 40 degrees F, submit a written statement of proposed cold weather construction procedures for approval.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.Submit sample of colored mortar with applicable masonry unit and color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture. Submit test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2 CLAY OR SHALE BRICK

Submit brick samples as specified. Color range and texture of clay or shale brick shall be as indicated and shall conform to the approved sample. Brick shall conform to ASTM C62; Grade SW shall be used for brick in contact with earth or grade and for all exterior work and for all nonvertical surfaces. Average dimensions of brick shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long (standard) or 4 inches thick, 2-2/3 inches high, and 8 inches long (nominal), subject to the tolerances specified in ASTM C62. Brick shall be tested for efflorescence. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.1 Solid Clay or Shale Brick

Solid clay or shale brick shall conform to ASTM C62, Type FBX. Brick size shall be modular and the nominal size of the brick used shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long (nominal) or 4 inches thick, 2-2/3 inches high and 8 inches long (nominal). Minimum compressive strength of the brick shall be 2200 psi.

2.2.2 Hollow Clay or Shale Brick

Hollow clay or shale brick shall conform to ASTM C652, Type HBX. Brick size shall be modular and the nominal size of the brick used shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long. Where vertical reinforcement is shown in hollow brick, the minimum cell dimension shall be 2-1/2 inches and the units shall be designed to provide precise vertical alignment of the cells. Minimum compressive strength of the brick shall be 2200 psi.

2.4 CONCRETE MASONRY UNITS (CMU)

Submit samples and certificates as specified. Cement shall have a low alkali content and be of one brand. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Units may contain post-consumer or post-industrial recycled content. Units shall be of modular dimensions and air, water, or steam cured. Surfaces of units

which are to be plastered or stuccoed shall be sufficiently rough to provide bond; elsewhere, exposed surfaces of units shall be smooth and of uniform texture. Exterior concrete masonry units shall have water-repellant admixture added during manufacture.

a. Hollow Load-Bearing Units: ASTM C90, made with lightweight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Hollow Non-Load-Bearing Units: ASTM C129, made with lightweight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

c. Solid Load-Bearing Units: ASTM C90, lightweight units. Provide solid units as indicated.

2.4.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification. Use industrial waste by-products (air-cooled slag, cinders, or bottom ash), ground waste glass and concrete, granulated slag, and expanded slag in aggregates. Slag shall comply with ASTM C989; Grade 80.

2.5 MORTAR FOR STRUCTURAL MASONRY

ASTM C270, Type S. Strength (f'm) as indicated. Test in accordance with ASTM C780. Use Type I portland cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar and 18 percent in masonry cement mortar. Use up to 40 percent Class F fly ash with type IP cement in cement-lime mortar. Fly ash shall comply with ASTM C593.

2.6 MASONRY MORTAR

Mortar Type S shall conform to the proportion specification of ASTM C270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; Type N cement-lime mortar proportions shall be 1 part cement, 1 part lime and 6 parts aggregate. Type N or S mortar shall be used for non-load-bearing, non-shear-wall interior masonry; and Type S for remaining masonry work; except where higher compressive strength is indicated on structural drawings. When masonry cement ASTM C91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C780 and ASTM C1072. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.6.1 Admixtures for Masonry Mortar

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall

contain less than 0.2 percent chlorides, and shall conform to ASTM C494/C494M, Type C. Submit the required certifications.

2.6.2 Hydrated Lime and Alternates

Hydrated lime shall conform to ASTM C207, Type S.

2.6.3 Cement

Portland cement shall conform to ASTM C150/C150M, Type I, II, or III. Masonry cement shall conform to ASTM C91, Type NS. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar. Incorporate to the maximum extent, without conflicting with other requirements of this section, up to 40 percent fly ash, up to 70 percent slag, up to 10 percent cenospheres, and up to 10 percent silica fume. When masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required. Additives shall conform to requirements in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

2.6.4 Pre-Mixed Mortar

Pre-mixed mortar shall conform to ASTM C1142, Type RS. Submit pre-mixed mortar composition.

2.6.5 Sand and Water

Sand shall conform to ASTM C144. Water shall be clean, potable, and free from substances which could adversely affect the mortar.

2.7 WATER-REPELLANT ADMIXTURE

Polymeric type formulated to reduce porosity and water penetration and water absorption of the mortar and masonry units.

2.8 GROUT AND READY-MIXED GROUT

Grout shall conform to ASTM C476, fine . Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 11 inches. Minimum grout strength shall be 2000 psi in 28 days, as tested by ASTM C1019. Use grout subject to the limitations of Table III. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Ready-Mixed grout shall conform to ASTM C94/C94M.

2.8.1 Admixtures for Grout

In cold weather, a non-chloride based accelerating admixture may be used subject to approval; accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C494/C494M, Type C. In general, air-entrainment, anti-freeze or chloride admixtures shall not be used except as approved by the Contracting Officer. Submit required certifications.

2.8.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.9 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A153/A153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A82/A82M. Wire ties or anchors in exterior walls shall conform to ASTM A641/A641M. Joint reinforcement in interior walls, and in exterior or interior walls exposed to moist environment shall conform to ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face. Submit two anchors, ties and bar positioners of each type used, as samples.

2.9.1 Wall Ties

Provide wall ties rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.9.2 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.10 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A82/A82M, welded construction.Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A153/A153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

2.11 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A615/A615M, Grade 60.

2.12 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.13 RIGID BOARD-TYPE INSULATION

Provide rigid board-type insulation as specified in Section 07 21 13 BOARD AND BLOCK INSULATION. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires. Submit certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

2.14 EXPANSION-JOINT MATERIALS

Sealant shall conform to Section 07 92 00 JOINT SEALANTS.

2.15 THROUGH WALL FLASHING

Flashing shall be specified in Section 07 60 00 FLASHING AND SHEET METAL.

a. Coated-Copper Flashing: 7 ounce, electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, elastic bituminous compound. Factory apply coating to a weight of not less than 6 ounces/square foot (approximately 3 ounces/square foot on each side).

b. Copper or Stainless Steel Flashing: Copper, ASTM B370, minimum 16 ounce weight; stainless steel, ASTM A167, Type 301, 302, 304, or 316, 0.015 inch thick, No. 2D finish. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.

2.16 WEEP HOLE VENTILATORS

Weep hole ventilators shall be prefabricated aluminum, plastic or wood blocking sized to form the proper size opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance or insects. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 PREPARATION

Prior to start of work, masonry inspector shall verify the applicable conditions as set forth in ACI 530/530.1, inspection.

3.1.1 Protection

Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F

b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.1.3 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.1.4 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.1.5 Surfaces

Clean surfaces on which masonry is to be placed of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

3.2 LAYING MASONRY UNITS

a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic.

b. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb.

c. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

d. In double wythe construction, the inner wythe may be brought up not more than 16 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

3.2.1 Forms and Shores

Provide bracing and scaffolding as required. Design bracing to resist wind pressure as required by local codes. Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.2 Reinforced Concrete Masonry Units Walls

Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Clay or Shale Brick Units

Lay brick facing with the better face exposed. Lay brick in running bond with each course bonded at corners, unless otherwise indicated. Lay molded brick with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid. Test clay or shale brick daily on the job, prior to laying, as follows: Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks. Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested.

3.2.4.2 Solid Units

Completely fill bed, head, and collar joints with mortar.

3.2.4.3 Hollow Units

Lay hollow units as specified for concrete masonry units.

3.2.4.4 Brick-Faced Walls

For brick-faced walls bond the two wythes in every sixth brick course with continuous horizontal joint reinforcement. Provide additional bonding ties spaced not more than 3 feet apart around the perimeter of and within 12 inches of all openings.

a. Collar Joints: Fill collar joints solid with mortar as each course of brick is laid. Do not disturb units in place.

b. Brick Sills: Lay brick on edge, slope, and project not less than 1/2 inch beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

3.2.4.5 Cavity Walls

Provide a continuous cavity as indicated. Securely tie the two wythes together with horizontal joint reinforcement. Bevel mortar beds away from cavity to prevent projection into cavity when bricks are shoved in place. Keep cavities clear and clean of mortar droppings. At the bottom of cavity walls, in the course immediately above the through-wall flashing, temporarily omit one brick every 4 feet. With a hose and clean water, wash all mortar droppings and debris out of the cavity through the temporary openings at least twice each day masonry is laid, and more often when required to keep the cavities clean. Fill in the openings with bricks and mortar after the wall is complete and the cavity has been inspected and found clean. Provide weep holes of open head joints spaced 24 inches o.c. wherever the cavity is interrupted and at base of wall and vertical obstructions (e.g. lintels).

3.2.5 Tolerances

Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Square corners unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, lay masonry within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

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In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation from level for bed joints and top surfaces of bearing walls

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In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of columns and in thickness of walls

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Minus	1/4 inch
Plus	1/2 inch

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.9 Embedded Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout.

3.2.10 Unfinished Work

Step back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved by the COR. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.2.11 Masonry Wall Intersections

Masonry bond each course at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond

beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.3 WEEP HOLES

Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated on drawings. Weep holes shall be open head joints. at 24 inches o.c. Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be perfectly horizontal or slightly canted downward to encourage water drainage outward and not inward. Weep holes shall be constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.4 MORTAR MIX

Mix mortar in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measure ingredients for mortar by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Mix water with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Retemper mortar that has stiffened because of loss of water through evaporation by adding water to restore the proper consistency and workability. Discard mortar that has reached its initial set or that has not been used within 2.5 hours after mixing.

3.5 REINFORCING STEEL

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.5.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.5.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.6 JOINT REINFORCEMENT INSTALLATION

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

3.7 PLACING GROUT

Fill cells containing reinforcing bars with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.7.1 Vertical Grout Barriers for Fully Grouted Walls

Provide grout barriers not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.7.2 Horizontal Grout Barriers

Embed grout barriers in mortar below cells of hollow units receiving grout.

3.7.3 Grout Holes and Cleanouts

3.7.3.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 16 inches on centers where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

3.7.3.2 Cleanouts for Hollow Unit Masonry Construction

Provide cleanout holes at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be

exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.7.3.3 Cleanouts for Solid Unit Masonry Construction

Provide cleanouts for construction of walls consisting of a grout filled cavity between solid masonry wythes at the bottom of every pour by omitting every other masonry unit from one wythe. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Do not plug cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.7.4 Grouting Equipment

3.7.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Operate pumps to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.7.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. Maintain at least one spare vibrator at the site at all times. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

3.7.5 Grout Placement

Lay masonry to the top of a pour before placing grout. Do no place grout in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.7.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours

that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.7.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses.Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

(1) The actual grout space or cell dimension shall be larger than the sum of the following items:

a) The required minimum dimensions of total clear areas given in the table above;

b) The width of any mortar projections within the space;

c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.8 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.9 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using mortar to fill the head joint in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07 92 00 JOINT SEALANTS. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.10 SHELF ANGLES

Adjust shelf angles as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized and provided in sections not longer than 10 feet and installed with a 1/4 inch gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.

3.11 LINTELS

3.11.1 Precast Concrete and Steel Lintels

Construct precast concrete and steel lintels as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true.

Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.12 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.12.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.12.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.13 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.14 NOT USED

3.15 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs or splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.15.1 Dry-Brushing

a. Exposed concrete masonry unit

b. Exposed concrete brick surfaces

c. Shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.15.2 Clay or Shale Brick Surfaces

Clean exposed clay or shale brick masonry surfaces as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, examine the sample panel of similar material for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, change the method of cleaning to ensure that the masonry surfaces in the structure will not be adversely affected.The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.16 BEARING PLATES

Set bearing plates for beams, joists, joist girders and similar structural members to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated.

3.17 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.18 NOT USED

3.19 TEST REPORTS

3.19.1 Field Testing of Mortar

Take at least three specimens of mortar each day. Spread a layer of mortar 1/2 to 5/8 inch thick on the masonry units and allowed to stand for one minute. Prepare and test the specimens for compressive strength in accordance with ASTM C780. Submit test results.

3.19.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days. Submit test results.

-- End of Section --

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 201	(2006) AISC Certification Program for Structural Steel Fabricators
AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2011) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 810	(1997) Design Guide 10: Erection Bracing of Low-Rise Structural Steel Buildings
ANSI/AISC 341	(2005; Suppl No. 1 2005) Seismic Provisions for Structural Steel Buildings
ANSI/AISC 360	(2010) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2007) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A490	(2010ae1) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2007a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2007) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2011) Standard Specification for Structural Steel Shapes
ASTM B695	(2004; R 2009) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C1107/C1107M	(2011) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C827/C827M	(2010) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
ASTM F 1554	(2007ae1) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F 436	(2011) Hardened Steel Washers
ASTM F 844	(2007a) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(2009) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel
SSPC PS 13.01	(1982; E 2004) Epoxy Polyamide Painting System
SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.756	Steel Erection; Beams and Columns

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer and galvanizing, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with ANSI/AISC 360 and ANSI/AISC 341 except as modified in this contract.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection Plan, including description of temporary supports;

Fabrication drawings including description of connections;

SD-03 Product Data

Shop primer

Welding electrodes and rods

Load indicator washers

Non-Shrink Grout

Include test report for Class B primer.

SD-06 Test Reports

Class B coating

Bolts, nuts, and washers

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel

Bolts, nuts, and washers

Galvanizing

Welding procedures and qualifications

1.4 QUALITY ASSURANCE

1.4.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Fabrication drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Double connections that require an erection seat to comply with OSHA 29 CFR 1926.756(c)(1) shall be shown on the shop drawings, reviewed and approved by the structural engineer of record. Use AWS A2.4 standard welding symbols. Member substitutions of details shown on the contract drawings shall be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.4.2 Certifications

1.4.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing.

1.4.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

Conform to all requirements specified in AWS D1.1/D1.1M.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Steel

ASTM A36/A36M.

2.1.2 High-Strength Structural Steel

2.1.2.1 Low-Alloy Steel

ASTM A572/A572M , Grade 50. ASTM A992/A992M Grade 50.

2.1.3 Structural Shapes for Use in Building Framing

Wide flange shapes, ASTM A992/A992M.

2.1.4 Structural Steel Tubing

ASTM A500/A500M, Grade B.

2.1.5 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B, weight class STD (Standard).

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel, Steel Pipe

2.2.1.1 Bolts

ASTM A307, Grade A; ASTM A325, Type 1. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F 844 washers for ASTM A307 bolts, and ASTM F 436 washers for ASTM A325 and ASTM A490 bolts.

2.2.2 High-Strength Structural Steel and Structural Steel Tubing

2.2.2.1 Bolts

ASTM A325, Type 1.

2.2.2.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

2.2.2.3 Washers

ASTM F 436, plain carbon steel.

2.2.3 Foundation Anchorage

2.2.3.1 Anchor Bolts

Galvanized ASTM F 1554.

2.2.3.2 Anchor Nuts

Galvanized ASTM A563, Grade A, hex style.

2.2.3.3 Anchor Washers

Galvanized ASTM F 844.

2.2.3.4 Anchor Plate Washers

ASTM A36/A36M.

2.2.4 Load Indicator Washers

ASTM F 959. Provide ASTM B695, Class 50, Type 1 galvanizing.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.3.2 Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage. Grout shall be nonmetallic.

2.3.3 Welded Shear Stud Connectors

AWS D1.1/D1.1M.

2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC 325 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 GALVANIZING

ASTM A123/A123M or ASTM A153/A153M, as applicable, unless specified otherwise galvanize after fabrication where practicable.

2.6 FABRICATION

2.6.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded or on surfaces of weathering steels that will be exposed in the completed structure. Do not locate match

markings in areas that will decrease member strength or cause stress concentrations. Affix embossed tags to hot-dipped galvanized members.

2.6.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.6.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.6.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

2.7 DRAINAGE HOLES

Adequate drainage holes shall be drilled to eliminate water traps. Hole diameter shall be 1/2 inch and location shall be indicated on the detail drawings. Hole size and location shall not affect the structural integrity.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 325. Fabrication and assembly shall be done in the shop to the greatest extent possible.

Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC 201 and primed with the specified paint.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

3.2 INSTALLATION

3.3 ERECTION

a. Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC 325. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.

b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC 303 and the structure shall be erected in accordance with AISC 810.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.3.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.4 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with ANSI/AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member. Holes shall not be cut or enlarged by burning. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.4.1 Common Grade Bolts

ASTM A307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.4.2 High-Strength Bolts

ASTM A325 and ASTM A490 bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.4.2.1 Installation of Load Indicator Washers (LIW)

ASTM F 959. Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F 436 washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening. In addition to the LIW, provide flat ASTM F 436 washers under both the bolt head and nut when ASTM A490 bolts are used.

3.5 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

3.6 WELDING

AWS D1.1/D1.1M. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

The Contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.6.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.7 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.7.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.8 GALVANIZING REPAIR

Provide as indicated or specified. Galvanize after fabrication where practicable. Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

3.9 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 2 working days of the date of weld inspection.

3.9.1 Welds

3.9.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification

inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

Inspection by the Government will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use.

3.9.1.2 Nondestructive Testing

AWS D1.1/D1.1M. Test locations shall be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

3.9.2 Load Indicator Washers

3.9.2.1 Load Indicator Washer Compression

Load indicator washers shall be tested in place to verify that they have been compressed sufficiently to provide the 0.015 inch gap when the load indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.005 inch gap when the load indicator washer is placed under the turned element, as required by ASTM F 959.

3.9.3 High-Strength Bolts

3.9.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in ANSI/AISC 360, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

3.9.3.2 Inspection

Inspection procedures shall be in accordance with ANSI/AISC 360. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

-- End of Section --

SECTION 05 21 19

OPEN WEB STEEL JOIST FRAMING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS B2.1	(2005; Errata 2006; Errata 2006) Welding Procedure and Performance Qualification
AWS D1.1/D1.1M	(2006; Errata 2006) Structural Welding Code - Steel

STEEL JOIST INSTITUTE (SJI)

SJI 279167 SPECS/LOADS	(2006) 42nd Edition Standard Specifications and Load Tables for Steel Joists and Joist Girders
SJI MANUAL	(2003) 75 Year Manual, 1928-2003
SJI TD 10	(2003) Technical Digest for the Design of Fire Resistive Assemblies with Steel Joists
SJI TD 8	(1983) Technical Digest for the Welding of Open Web Steel Joists
SJI TD 9	(2006) Technical Digest for the Handling and Erection of Steel Joists and Joist Girders

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 14.01	(1982; E 2004) Steel Joist Shop Painting System
SSPC Paint 15	(1999; R 2004) Steel Joist Shop Primer/Metal Building Primer

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1200	Hazard Communication
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.757	Steel Erection; Open Web Steel Joists

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welder qualification;

SD-02 Shop Drawings

Steel joist framing;

SD-06 Test Reports

Erection inspection

Welding inspections

SD-07 Certificates

Accessories

Certification of Compliance

1.3 REGULATORY REQUIREMENT

All joist girder framing must conform to 29 CFR 1926.757. Secure all joist bridging and anchoring in place prior to the application of any construction loads. Distribute temporary loads so that joist capacity is not exceeded. Do not apply loads to bridging.

1.4 DELIVERY AND STORAGE

Handle, transport, and store joists in a manner to prevent damage affecting their structural integrity. Store all items off the ground in a well drained location protected from the weather and easily accessible for inspection and handling.

1.5 QUALITY ASSURANCE

All work must comply with the requirements set forth in 29 CFR 1926.

1.5.1 Drawing Requirements

Submit steel joist framing drawings. Show joist type and size, layout in plan, and erection details including methods of anchoring, framing at openings, type and spacing of bridging, and details of accessories as applicable.

1.5.2 Certification of Compliance

Prior to construction commencement, submit Material Safety Data Sheet per 29 CFR 1910.1200 for steel joists , and certification for welder qualification, compliance with AWS B2.1, welding operation, and tacker, stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

Submit certification of compliance for the following:

SJI MANUAL
SJI TD 8
SJI TD 9
SJI TD 10
29 CFR 1926
29 CFR 1926.757

PART 2 PRODUCTS

2.1 JOISTS AND ACCESSORIES

Provide design data from SJI 279167 SPECS/LOADS for the joist series indicated.

2.2 PAINTING

2.2.1 Shop Painting

Clean and prime joists in accordance with SSPC Paint 15 and SSPC PS 14.01, Steel Joist Shop Painting System, using only Type I, "Red Oxide Paint."

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Handling and Erection

Conform to SJI 279167 SPECS/LOADS for the joist series indicated.

3.1.2 Welding

All welding must conform to AWS B2.1 and AWS D1.1/D1.1M.

3.2 BEARING PLATES

Provide bearing plates to accept full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate must be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout must be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.3 PAINTING

3.3.1 Touch-Up Painting

After erection of joists, touch-up connections and areas of abraded shop coat with paint of the same type used for the shop coat.

3.3.2 Field Painting

Paint joists requiring a finish coat in conformance with the requirements of Section 09 90 00 PAINTING AND COATING.

3.4 VISUAL INSPECTIONS

3.4.1 Erection Inspection

AWS D1.1/D1.1M, Section 6. Perform erection inspection and field welding inspections with AWS certified welding inspectors. Welding inspectors must visually inspect and mark welds.

-- End of Section --

SECTION 05 30 00

STEEL DECKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100	(1991; R 2008) Cold-Formed Steel Design Manual
AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

FM GLOBAL (FM)

FM DS 1-28	(2002) Design Wind Loads

STEEL DECK INSTITUTE (SDI)

SDI 31	(2007) Design Manual for Composite Decks, Form Decks, and Roof Decks
SDI DDMO3	(2004; Errata 2006; Add 2006) Diaphragm Design Manual; 3rd Edition
SDI DDP	(1987; R 2000) Deck Damage and Penetrations
SDI MOC2	(2006) Manual of Construction with Steel Deck

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20	(2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2010) Structural Engineering

UNDERWRITERS LABORATORIES (UL)

UL 209	(2005; Reprint May 2007) Cellular Metal Floor Raceways and Fittings
UL 580	(2006; Reprint Jul 2009) Tests for Uplift Resistance of Roof Assemblies

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

SD-03 Product Data

Accessories

Galvanizing Repair Paint

Joint Sealant Material

Mechanical Fasteners

Repair Paint

Welder Qualifications

Welding Equipment

Welding Rods and Accessories

SD-07 Certificates

Welding Procedures

Wind Storm Resistance

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide manufacturer's certificates attesting that the decking material meets the specified requirements.

1.3.2 Qualifications for Welding Work

Follows Welding Procedures in accordance with AWS D1.1/D1.1M.

Submit qualified Welder Qualifications in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories.

1.3.3 Regulatory Requirements

1.3.3.1 Wind Storm Resistance

Provide roof construction assembly capable of withstanding an uplift pressure of 90 pounds per square foot when tested in accordance with the uplift pressure test described in the FM DS 1-28 or as described in UL 580 and in general compliance with UFC 3-301-01.

1.3.4 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated

covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of AISI D100.

1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Sheet

Flat rolled carbon steel sheets of structural quality, thickness not less than indicated before coating, meeting the requirements of AISI SG03-3, except as modified herein.

2.1.2 Steel Coating

ASTM A653/A653M designation 2180 G60 galvanized, or ASTM A792/A792M designation AZ55, aluminum-zinc alloy. Apply coating to both sides of sheet. Conform to UL 209 for coating on decking provided as wire raceways.

2.1.3 Mixes

2.1.3.1 Galvanizing Repair Paint for all Decks

Provide a high-zinc-dust content paint for regalvanizing welds in galvanized steel conforming to ASTM A780/A780M.

2.1.4 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to ASTM A36/A36M, merchant quality, Grade Designation SAE/AISI 1023 or SAE/AISI 1025, and hot-dip galvanized in accordance with ASTM A123/A123M.

2.1.5 Joint Sealant Material for Roof Decks

Provide a nonskinning, gun-grade, bulk compound material as recommended by the manufacturer.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.028 inch thick to close open ends at end walls, and openings through deck.

2.2.3 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.2.4 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated or pneumatically driven fasteners, for anchoring the deck to structural supports and adjoining units that are designed to meet the loads indicated. Provide positive locking-type fasteners listed by the Steel Deck Institute and ICC-ES, as approved by the Contracting Officer.

2.2.5 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0295 inch other metal accessories, 0.0358 inch unless otherwise indicated. Accessories must include but not be limited to saddles, welding washers, fasteners, underlapping sleeves.

2.3 FABRICATION

2.3.1 Roof Deck

Conform to ASTM A792/A792M or ASTM A1008/A1008M for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of the steel design thickness required by the design drawings and galvanized.

2.3.1.1 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal 0.0359 inch thick before galvanizing. Bend strips to form a 45-degree cant not less than 5 inch wide, with top and bottom flanges a minimum 3 inch wide. Length of strips 10 feet.

2.3.1.2 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0359 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

2.3.2 Form Deck

Conform to ASTM A653/A653M or ASTM A1008/A1008M. Fabricate form deck of the steel design thickness required by the design drawings. Zinc-coat in conformance with ASTM A653/A653M, G60 coating class.

2.3.3 Touch-Up Paint

Provide touch-up paint for zinc-coated units of an approved galvanizing repair paint with a high-zinc dust content. Touch-up welds with paint conforming to SSPC Paint 20 in accordance with ASTM A780/A780M. Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

For floor decking installation, wire brush, clean, and touchup paint the scarred areas on the top and bottom surfaces of the metal floor decking and on the surface of supporting steel members. Include welds, weld scars, bruises, and rust spots for scarred areas. Touched up the galvanized surfaces with galvanizing repair paint. Touch up the painted surfaces with paint for the repair of painted surfaces.

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with SDI DDMO3 and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical.Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 5/8 inch diameter puddle welds or fastened with screws, powder-actuated fasteners, or pneumatically driven fasteners as indicated on the design drawings and in accordance with manufacturer's recommended procedure and SDI 31. Clamp or weight deck units

to provide firm contact between deck units and structural supports while performing welding or fastening. Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Welding

Perform welding in accordance with AWS D1.3/D1.3M using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in AWS D1.1/D1.1M and AWS D1.3/D1.3M make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. Conform to the recommendations of the Steel Deck Institute and the steel deck manufacturer for location, size, and spacing of fastening. Do not use welding washers at the connections of the deck to supports. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Lap 2 inch deck ends. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of SDI DDMO3. Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of coated finish with zinc-dust paint conforming to ASTM A780/A780M.

3.2.1.2 Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners as listed by the Steel Deck Institute, ICC-ES, the fastener and steel deck manufacturers, and approved by the Contracting Officer. Drive the powder-actuated fasteners with a low-velocity piston tool by an operator authorized by the manufacturer of the powder-actuated tool. Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations.

3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP.Reinforce holes and openings 6 to 12 inch across by 0.0474 inch thick steel sheet at least 12 inch wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inch on center. Reinforce holes and openings larger than 12 inch by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists.

3.2.3 Deck Damage

SDI MOC2, for repair of deck damage.

3.2.4 Accessory Installation

3.2.4.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.2.5 Concrete Work

Prior to placement of concrete, inspect installed decking to ensure that there has been no permanent deflection or other damage to decking. Replace decking which has been damaged or permanently deflected as approved by the Contracting Officer. Place concrete on metal deck in accordance with Construction Practice of SDI 31.

3.3 JOINT SEALING FOR ROOF DECKS

Seal sidelaps and endlaps with manufacturer's recommended joint sealing material. Shop or field apply the material. Before applying the sealing material, completely remove dust, dirt, moisture, and other foreign material from the surfaces to which the sealing material is to be applied. Apply sealing material in strict accordance with the sealing material manufacturer's printed instructions.

3.4 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

3.5 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

3.6 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.7 FIELD QUALITY CONTROL

3.7.1 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges is 1/16 inch; when gap is more than 1/16 inch, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

-- End of Section --

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG02-KIT	(2001; Supp 1 2004) North American Specification for the Design of Cold-Formed Steel Structural Members
AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M	(2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A370	(2011) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1513	(2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM C955	(2011b) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM E329	(2011b) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

ASTM F 1941	(2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
ASTM F 1941M	(2007) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Metric)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components;

a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.

b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.

c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

SD-03 Product Data

Steel studs,joists, tracks, bracing, bridging and accessories

SD-05 Design Data

Metal framing calculations;

SD-07 Certificates

Welds

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Finish of the framing members shall be

maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust. Replace damaged items with new, as directed by the Contracting Officer.

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI SG03-3.

1.5 MAXIMUM DEFLECTION

a. Floor Joists:

L/360 - Live load only
L/240 - Total load

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit framing components to show sizes, thicknesses, layout, material designations, methods of installation, and accessories.

1.6.2 Design Data Required

Submit metal framing calculations to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation. Submit metal framing calculations for any connections, member sizes, or anchorage that deviates from the drawings, provide structural analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

PART 2 PRODUCTS

2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with ASTM C955 and the following.

2.1.1 Studs and Joists of 16 Gage (0.0598 Inch) and Heavier

Galvanized steel, ASTM A653/A653M, SS Grade 50, G60.

2.1.2 Studs and Joists of 18 Gage (0.0478 Inch) and Lighter

Studs and Joists of 18 Gage (0.0478 Inch) and Lighter, Track, and Accessories (All Gages): Galvanized steel, ASTM A653/A653M, SS, Grade 50 33,000 psi G60.

2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Size and gage as indicated. Steel stud deflection shall be limited to L/600 for exterior wall brick veneer construction.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

a. An ICC number.

b. Manufacturer's identification.

c. Minimum delivered uncoated steel thickness.

d. Protective coating designator.

e. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling, tapping screws in compliance with ASTM C1513 of the type, size and location as shown on the drawings. Electroplated screws shall have a minimum 5 micron zinc coating in accordance with ASTM F 1941. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M as appropriate.

2.4 PAINT

Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with corrosion-inhibiting primer, SSPC Paint 25.

2.5 PLASTIC GROMMETS

Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires. Prevent metal to metal contact for plumbing pipes.

PART 3 EXECUTION

3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.1.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI SG02-KIT. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 18 gage.

3.1.2 Screws

Screws shall be self-drilling self-tapping type, size, and location shown on the drawings. Screw penetration through joined materials shall not be less

than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-KIT. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

3.1.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location shown on the drawings.

3.2 INSTALLATION

3.2.1 Tracks

Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 3 inches from the edge of concrete slabs.

3.2.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 2 feet wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI SG03-3, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

LOAD	HEIGHT	BRACING
Axial load	Up to 3000 mm 10 feet	Two rows at 1/3 points
	Over 3000 mm 10 feet	Rows 900 mm 3'-4" o.c. maximum

3.2.3 Joists

Locate each joist directly above a stud. Provide doubled joists under parallel partitions wherever partition length exceeds 1/2 of joist span. Joists shall have at least 2.50 inches of bearing on steel, 4 inches on masonry, and shall be reinforced over bearings where required to prevent web crippling. Splice joists over bearings only. Lap and weld splices as indicated. Provide manufacturer's standard bridging which shall not be less than the following:

CLEAR SPAN	BRIDGING
Up to 4200 mm 14 feet	One row near center
4200 mm to 6000 mm 14 to 20 feet	Two rows at 1/3 points
6000 mm to 7800 mm 20 to 26 feet	Three rows at 1/4 points
7800 mm to 10600 mm 26 to 32 feet	Four rows at 1/5 points

Temporary bracing shall be provided and remain in place until work is permanently stabilized.

3.2.4 Erection Tolerances

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

(1) Layout of walls and partitions: 1/4 inch from intended position;

(2) Plates and runners: 1/4 inch in 8 feet from a straight line;

(3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 1/4 inch in 8 feet from a true plane.

b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

(1) Layout of walls and partitions: 1/4 inch from intended position;

(2) Plates and runners: 1/8 inch in 8 feet from a straight line;

(3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.3	(2006) Operations - Safety Requirements for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.21.1	(2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.6.2	(1998; R 2010) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series
ASME B18.6.3	(2010) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A467/A467M	(2007) Standard Specification for Machine Coil Chain
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B108/B108M	(2008) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B26/B26M	(2009) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C1513	(2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; R 2011e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

ASTM E488 (1996; R 2003) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Embedded angles and plates, installation drawings;

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A36/A36M.

2.1.2 Structural Tubing

ASTM A500/A500M.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.1.5 Anchor Bolts

ASTM A307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.5.1 Post Installed Anchors

Provide diameter as indicated on drawings. Minimum embedment shall be per manufacturer's requirements. Design values listed shall be as tested according to ASTM E488.

a. Minimum allowable pullout value shall be as indicated on drawings.

b. Minimum allowable shear value shall be as indicated on drawings.

2.1.5.2 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

2.1.5.3 Toggle Bolts

ASME B18.2.1.

2.1.5.4 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 or ASTM A307.

2.1.5.5 Powder Actuated Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

2.1.5.6 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.1.5.7 Washers

Provide plain washers to conform to ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.1.

2.1.6 Aluminum Alloy Products

Conform to ASTM B209 for sheet plate, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, 2180 G60, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with a standard mill finish. Provide a coating thickness not less than that specified for protective and decorative

type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45. Provide a polished satin finish on items to be anodized.

2.3 GUARD POSTS (BOLLARDS/PIPE GUARDS)

Provide 8 inch galvanized standard weight steel pipe as specified in ASTM A53/A53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.4 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 inches bearing on masonry at each end.

Provide angles and plates, ASTM A36/A36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A123/A123M.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.6 FINISHES

3.6.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

3.6.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.6.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

-- End of Section --

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20	(2010) American Softwood Lumber Standard

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Eng Man	(2010) Manual for Railway Engineering

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E445	(2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
APA F405	(1999) Performance Rated Panels
APA L870	(2010) Voluntary Product Standard, PS 1-09, Structural Plywood
APA S350	(2011) Performance Standard for Wood-Based Structural-Use Panels

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts
ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM D3498	(2011) Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
ASTM D6007	(2002; R 2008) Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber
ASTM E1333	(2010) Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

FOREST STEWARDSHIP COUNCIL (FSC)

FSC-STD-01-001	(1993; R 2002) FSC Principles and Criteria (version 4-0) EN

GREEN SEAL (GS)

GS-36	(2000) Green Seal Standard, Adhesives for Commercial Use

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2007) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2006) Standard Grading Rules for Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec	(1986; Supple. No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2002) Standard Grading Rules for Southern Pine Lumber

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS56	(1973) Structural Glued Laminated Timber

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923	(Rev A; Notice 2) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 2) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors
CID A-A-1925	(Rev A; Notice 2) Shield Expansion (Nail Anchors)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(1998) Western Lumber Grading Rules

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Modifications of structural members;

Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

1.4.2 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870.Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

1.4.3 Structural-Use and OSB Panels

Mark each panel with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the panel. The mark shall indicate end use, span rating, and exposure durability classification. Oriented Strand Board (OSB), APA F405.

1.5 SIZES AND SURFACING

ALSC PS 20 for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

a. Framing lumber and board, 19 percent maximum

b. Materials other than lumber; moisture content shall be in accordance with standard under which the product is produced

1.7 QUALITY ASSURANCE

1.7.1 Drawing Requirements

For fabricated structural members, trusses, qlue-lam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.2 Data Required

Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.3 Certificates of Grade

Submit certificates attesting that products meet the grade requirements specified in lieu of grade markings where appearance is important and grade marks will deface material.

1.7.4 Humidity Requirements

Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

1.8 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible. Lumber shall be FSC-certified.

2.1.2 Engineered Wood Products

Products shall be FSC-certified and shall contain no added urea-formaldehyde if exposed to interior spaces. Determine formaldehyde concentrations in air from engineered wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or ASTM E1333. Products shall not be used if formaldehyde concentration is found to be greater than 0.

2.2 LUMBER

2.2.1 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed. Finger-jointed lumber may be used in the same applications as solid lumber of an equivalent species and grade, provided the finger-jointed lumber meets all the requirements of the certification and the quality control programs of the rules writing agency having jurisdiction and all applicable requirements of DOC/NIST PS56.

Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common

NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.3 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS

APA L870, APA S350, APA E445, and APA F405 respectively.

2.3.1 Wall Sheathing

2.3.1.1 Plywood

C-D Grade, Exposure 1, and a minimum thickness of 1/2 inch , except where indicated to have greater thickness. FSC-certified.

2.3.1.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1, Span Rating of 16/0 or greater. OSB, APA Rated Sheathing. OSB shall be a phenolic-glued, low-formaldehyde board. FSC-certified.

2.3.2 Other Uses

2.3.2.1 Plywood

Plywood for casework. Plywood shall be FSC-certified.

2.3.2.2 Structural-Use and OSB Panels

Structural-use and OSB panels for casework. Panels shall be FSC-certified.

2.4 OTHER MATERIALS

2.4.1 Miscellaneous Wood Members

2.4.1.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm inch
Bridging	25 x 75 1 x 3 or 25 x 100 1 x 4 for use between members 50 x 300 2 x 12 and smaller; 50 x 100 2 x 4 for use between members larger than 50 x 300 2 x 12.
Corner bracing	25 x 100 1 x 4.
Furring	25 x [50] [75] 1 x 2
Grounds	Plaster thickness by 38.
Nailing strips	25 x 75 1 x 3 or 25 x 100 1 x 4 when used as shingle base or interior finish, otherwise 50 mm 2 inch stock.

2.4.1.2 Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

2.4.1.3 Blocking

Blocking shall be standard or number 2 grade.

2.4.2 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials, GS-36, SCAQMD Rule 1168, and as specified. Use water-based adhesives with maximum VOC content of 15 grams/liter for all interior applications. Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of LEED low emitting materials credit.

2.5 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Fasteners shall be fabricated from 100 percent re-melted steel.See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Fasteners may contain post-consumer or post-industrial recycled content. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip zinc-coated in accordance with ASTM A153/A153M.

2.5.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.5.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.5.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices shall be 3/8 inch.

2.5.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.5.5 Wood Screws

ASME B18.6.1.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Sills

3.1.1.1 Anchors in Masonry

Except where indicated otherwise, Embed anchor bolts not less than 15 inches in masonry unit walls and provide each with a nut and a 2 inch diameter washer at bottom end. Fully grout bolts with mortar.

3.1.1.2 Anchors in Concrete

Except where indicated otherwise, Embed anchor bolts not less than 8 inches in poured concrete walls and provide each with a nut and a 2 inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend shall be not less than 90 degrees. Powder-actuated fasteners spaced 3 feet o.c. may be provided in lieu of bolts for single thickness plates on concrete.

3.1.2 Subflooring

3.1.2.1 Plywood, Structural-Use, and OSB Panels

Apply best side up with the grain of outer plies or the long dimension at right angles to joists. Stagger end joints and locate over the centerline of joists. Support panel edges by nominal 2 by 4 members framed between joists so the edge joints of subfloor occur over the centerline of blocking. Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Panels shall be continuous over two or more spans. Nail panels 6 inches o.c. at supported edges and 10 inches o.c. over intermediate bearing. Nails shall be 8-penny common or 6-penny threaded. Provide at least 1/2 inch clearance between subflooring and masonry or concrete walls. Subflooring may be installed with adhesive conforming to ASTM D3498 and nails spaced at 12 inches on center unless otherwise shown.

3.1.3 Wall Sheathing

3.1.3.1 Plywood, Structural-Use, and OSB Panel Wall Sheathing

Apply horizontally or vertically. Extend sheathing over and nail to sill and top plate. Abut sheathing edges over centerlines of supports. Allow 1/8 inch spacing between panels and 1/8 inch at windows and doors. If sheathing is applied horizontally, stagger vertical end joints. Nail panels with 6-penny nails spaced 6 inches o.c. along edges of the panel and 12 inches o.c. over intermediate supports. Keep nails 3/8 inches away from panel ledges. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

3.1.4 Wood Sheathing

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width.

-- End of Section --

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20	(2010) American Softwood Lumber Standard

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M2	(2007) Standard for Inspection of Treated Wood Products
AWPA M4	(2002) Standard for the Care of Preservative-Treated Wood Products
AWPA P5	(2009) Standard for Waterborne Preservatives

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA PS 1	(1995) Voluntary Product Standard for Construction and Industrial Plywood

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(8th Edition) AWI Quality Standards

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM F 547	(2006) Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	(2010) Cabinet Hardware

FOREST STEWARDSHIP COUNCIL (FSC)

FSC-STD-01-001	(1993; R 2002) FSC Principles and Criteria (version 4-0) EN

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

HPVA HP-1	(2009) American National Standard for Hardwood and Decorative Plywood

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2007) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2006) Standard Grading Rules for Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2002) Standard Grading Rules for Southern Pine Lumber

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS58	(1973) Basic Hardboard (ANSI A135.4)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(1998) Western Lumber Grading Rules

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 4	(2009) Water-Repellent Preservative Non-Pressure Treatment for Millwork

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Submit documentation verifying that no urea-formaldehyde resins were used.

SD-07 Certificates

Certificates of grade

Certificates of compliance

1.3 DETAIL DRAWINGS

The Contractor shall submit detail drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

1.4 CERTIFICATES

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC-STD-01-001 and identify certifying organization.

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

Provide certificates of compliance unless materials bear certification markings or statements.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver lumber, plywood, trim, and millwork to job site in an undamaged condition. Stack materials to ensure ventilation and drainage. Protect against dampness before and after delivery. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity. Do not store products in building until wet trade materials are dry.

1.6 QUALITY ASSURANCE

1.6.1 Lumber

Identify each piece or each bundle of lumber, millwork, and trim by the grade mark of a recognized association or independent inspection agency that

is certified by the Board of Review, American Lumber Standards Committee, to grade the species.

1.6.2 Plywood

Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of the plywood. Mark shall identify plywood by species group or span rating, and shall show exposure durability classification, grade, and compliance with APA PS 1.

1.6.3 Hardboard and Particleboard

Materials shall bear a marking or statement identifying the producer and the applicable standard.

1.6.4 Pressure-Treated Lumber and Plywood

Each treated piece shall be inspected in accordance with AWPA M2.

1.6.5 Nonpressure-Treated Woodwork and Millwork

Mark, stamp, or label, indicating compliance with WDMA I.S. 4.

PART 2 PRODUCTS

2.1 WOOD

2.1.1 Sizes and Patterns of Wood Products

Yard and board lumber sizes shall conform to ALSC PS 20. Provide shaped lumber and millwork in the patterns indicated and standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the applicable standard.

2.1.2 Trim, Finish, and Frames

Provide species and grades listed for materials to be paint finished. Provide materials that are to be stain, natural, or transparent finished one grade higher than that listed. Provide species indicated for materials to be transparent finished. Run trim, except window stools and aprons with hollow backs.

TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH

Grading Rules	Species	Interior Trim, Finish, and Frames
WWPA G-5 grading rules	Aspen Douglas Fir-Larch Douglas Fir-South Engelmann Spruce -Lodgepole Pine Engelmann Spruce Hem-Fir Idaho White Pine	All Species: C & Btr. Select (Choice & Btr Idaho White Pine) or Superior Finish. Western Red Cedar may be graded C & Btr. Select or A & Btr. per Special Western Red Cedar

	Lodgepole Pine Mountain Hemlock Mountain Hemlock -Hem-Fir Ponderosa Pine- Sugar Pine (Ponderosa Pine -Lodgepole Pine) White Woods (Western Woods) Western Cedars Western Hemlock	Rules.
WCLIB 17 standard grading rules	Douglas Fir-Larch Hem-Fir Mountain Hemlock Sitka Spruce Western Cedars Western Hemlock	All Species: C & Btr VG, except A for Western Red Cedar
SPIB 1003 grading rules	Southern Pine	C & Btr
NHLA Rules	Cypress	C-Select
NELMA Grading Rules standard grading rules	Balsam Fir Eastern Hemlock- Tamarack Eastern Spruce Eastern White Pine Norway Pine Northern Pine Northern White Cedar	All Species: C-Select except C & Btr for Eastern White Pine and Norway Pine
RIS Grade Use standard specifications	Redwood	Clear Clear All Heart
NHLA Rules rules	Cypress	B Finish
	Red Gum Soft Elm Birch	Select or Btr (for interior use only)

2.1.3 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA G-5, 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

2.1.4 Softwood Plywood

APA PS 1, thicknesses as indicated.

a. Plywood for Shelving: Interior type, A-B Grade, any species group.

b. Plywood for Countertops: Exterior type, A-C Grade.

2.1.5 Hardwood Plywood

HPVA HP-1, Type II (Interior) , Premium (A) Grade, hardwood veneer core construction, face veneers of thickness indicated.

2.1.6 Hardboard

DOC/NIST PS58, standard type, 1/8 inch thick.

2.2 COUNTER TOPS

2.2.1 Laminated Plastic

ANSI/NEMA LD 3.

2.2.1.1 Countertop Finish

Grade GP 50 or PF 42, satin finish. Color and pattern shall be as indicated.

2.2.1.2 Backing Sheet

BK 20.

2.2.2 Solid Surface

Manufactured from homogeneous solid sheets for filled plastic resin complying with materials and performance requirements of ANSI Z 124.3, for Type 5 or Type 6, without a precoated finish.

2.3 MOISTURE CONTENT OF WOOD PRODUCTS

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products at time of delivery to the job site, and when installed, shall be as follows:

a. Interior Finish Lumber, Trim, and Millwork 1-1/4 Inches Nominal or Less in Thickness: 6 percent on 85 percent of the pieces and 8 percent on remainder.

b. Moisture content of other materials shall be in accordance with the applicable standards.

2.4 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

2.4.1 Pressure Treatment

Lumber and plywood used on the exterior of buildings or in contact with masonry or concrete shall be treated with water-borne preservative listed in AWPA P5 as applicable, and inspected in accordance with AWPA M2. Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standards Committee. Plywood shall be treated to a reflection level as follows:

Exterior wood molding and millwork within 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.5 HARDWARE

Provide sizes, types, and spacings of manufactured building materials recommended by the product manufacturer except as otherwise indicated or specified.

2.5.1 Wood Screws

ASME B18.6.1.

2.5.2 Bolts, Nuts, Lag Screws, and Studs

ASME B18.2.1 and ASME B18.2.2.

2.5.3 Nails

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

2.5.4 Adjustable Shelf Standards

ANSI/BHMA A156.9, Type, surface mounted, with shelf rests Type, bracket.

2.6 FABRICATION

2.6.1 Quality Standards (QS)

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in AWI Qual Stds. Items not specified to be of a specific grade shall be Custom grade. The AWI QS is superseded by all contract document requirements indicated or stated herein.

2.6.2 Countertops

Fabricate with lumber and a core of exterior plywood, glued and screwed to form an integral unit. Bond laminated plastic under pressure to exposed surfaces, using type of glue recommended by plastic manufacturer, and bond a backing sheet under pressure to underside of countertop. Countertop unit shall be post-formed type with no-drip nose, cove moulding, and Style A back splash, and covered with ANSI/NEMA LD 3, Grade PF 42 plastic. Back splash shall be not less than 3-1/2 inches nor more than 4-1/2 inches high.

2.6.3 Cabinets

Wall and base cabinets shall be of the same construction and appearances. Fabricate with solid ends and frame fronts, or with frames all around.

Frames shall be solid hardwood not less than 3/4 by 1-1/2 inches. Ends, bottom, back, partitions, and doors shall be hardwood plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Cover exposed edges of plywood with hardwood strips. Doors, frames, and solid exposed ends shall be 3/4 inch thick; bottom, partitions, and framed ends 1/2 inch minimum; shelves 5/8 inch minimum; back 1/4 inch minimum.

2.6.3.1 Cabinet Hardware

ANSI/BHMA A156.9. Provide cabinet hardware including two self-closing hinges for each door, two side-mounted metal drawer slides for each drawer and pulls for all doors and drawers as follows. Hardware exposed to view shall be stainless steel. All cabinet hardware shall comply with the following requirements:

a. Provide concealed Euro-Style, back mounted hinges with opening to 165 degrees with self-closing feature at less than 90 degrees to its closed position.

b. Drawer slides shall have a static rating capacity of 100 lbs. The slides shall have a self-closing/stay-closed action, zinc or epoxy coated steel finish, ball bearing rollers, and positive stop with lift out design.

c. Drawer pulls shall be wire type pulls with center-to-center dimension not less than3-1/2 inches and cross sectional diameter of 5/16 inch. The handle projection shall be not less than 1-5/16 inches.

d. Drawer catch shall be heavy duty magnetic catch.

2.6.3.2 Finish

Provide a natural factory finish on wood surfaces after fabrication. Finish shall be fabricator's standard natural finish, except that it shall be equivalent to one coat of sealer and one coat of spar varnish on all surfaces and a second coat of spar varnish on surfaces exposed to view. Sand lightly and wipe clean between coats.

2.6.4 Workbenches

Fabricate as indicated. Dovetail and glue drawer corners. Fasten frames with suitable wood screws or bolts. Sand exposed surfaces smooth, and ease exposed edges. Provide two side-mounted, metal, ball-bearing drawer slides for each door.

2.6.5 Casework With Transparent Finish (CTF)

2.6.5.1 AWI Quality Grade (CTF)

Premium grade.

2.6.5.2 Construction (CTF)

Details shall conform to reveal overlay design.

2.6.5.3 Exposed Parts

Oak specie, rotary cut.

2.6.5.4 Semi-Exposed Parts

As specified in the AWI Qual Stds for the grade selected.

2.6.6 Casework With High Pressure Laminate Finish (CHPL)

2.6.6.1 AWI Quality Grade (CHPL)

Premium grade.

2.6.6.2 Construction (CHPL)

Details shall conform to reveal overlay design.

2.6.6.3 Exposed Surfaces

High pressure laminate, color and pattern as indicated.

2.6.6.4 Semi-Exposed Surfaces

As specified in the AWI Qual Stds for the grade selected.

PART 3 EXECUTION

3.1 FINISH WORK

Provide sizes, materials, and designs as indicated and as specified. Apply primer to finish work before installing. Where practicable, shop assemble and finish items of built-up millwork. Joints shall be tight and constructed in a manner to conceal shrinkage. Miter trim and moldings at exterior angles and cope at interior angles and at returns.Material shall show no warp after installation. Install millwork and trim in maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

3.1.1 Exterior Finish Work

Machine-sand exposed flat members and square edges. Machine-finish semi-exposed surfaces. Construct joints to exclude water. In addition to nailing, glue joints of built-up items with waterproof glue as necessary for weather-resistant construction. Provide well distributed end joints in built-up members. Provide shoulder joints in flat work. Hold backs of wide-faced miters together with metal rings and waterproof glue. Fascias and other flat members, unless otherwise indicated, shall be 3/4 inch thick. Provide door and window trim in single lengths. Provide braced, blocked, and rigidly anchored cornices for support and protection of vertical joints. Install soffits in largest practical size. Joints of plywood shall occur over center lines of supports. Fasten soffits with aluminum or stainless steel nails. Back prime all concealed surfaces of exterior trim.

3.1.2 Interior Finish Work

After installation, sand exposed surfaces smooth. Provide window and door trim in single lengths.

3.2 SHELVING

1 inch nominal thick wood shelf material or 3/4 or 23/32 inch thick plywood shelf material supported substantially with end and intermediate supports and arranged to prevent buckling and sagging. Provide cleats except where hook strips are specified or indicated. Where adjustable shelving is indicated, provide standards and brackets or shelf rests for each shelf. Anchor standards to wall at not more than 2 feet o.c.

3.3 MISCELLANEOUS

3.3.1 Counters

Construct as indicated. Conceal fastenings where practicable, fit counter neatly, install in a rigid and substantial manner, and scribe to adjoining surfaces. Provide counter sections in longest lengths practicable; keep joints in tops to a minimum; and where joints are necessary, provide tight hairline joints drawn up with concealed-type heavy pull-up bolts. Glue joints with water-resistant glue and, in addition, make rigid and substantial with screws, bolts, or other approved fastenings.

3.3.2 Cabinets

Install level, plumb, and tight against adjacent walls. Secure cabinets to walls with concealed toggle bolts, and secure top to cabinet with concealed screws. Make cut-outs for fixtures to templates supplied by fixture manufacturer. Carefully locate cut-outs for pipes so that edges of holes will be covered by escutcheons.

3.3.3 Workbenches

Construct as indicated. Install level, plumb, and tight against adjacent construction. Fasten to walls with screws or toggle bolts and to floors with expansion bolts.

3.3.4 Wood Bumpers

Bore, countersink, and bolt in place where indicated.

3.4 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints.Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners.Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

-- End of Section --

SECTION 06 41 16.00 10

LAMINATE CLAD ARCHITECTURAL CASEWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A161.2	(1998) Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(8th Edition) AWI Quality Standards

ASTM INTERNATIONAL (ASTM)

ASTM F 547	(2006) Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	(2010) Cabinet Hardware

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.2	(2009) Medium Density Fiberboard (MDF) for Interior Applications

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 1-A	(2007) Architectural Wood Flush Doors

1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework cabinets as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

SD-03 Product Data

Wood Materials;
Wood Finishes;
Finish Schedule;

SD-04 Samples

Plastic Laminates;
Cabinet Hardware;

SD-07 Certificates

Laminate Clad Casework

1.4 QUALITY ASSURANCE

1.4.1 General Requirements

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the premium grade quality standards as outlined in AWI Qual Stds, Section 400G and Section 400B for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of AWI Qual Stds requirements, in general, and the specific AWI Qual Stds requirements provided in this specification. The quality control statement shall also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

1.5 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

1.6 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Lumber

a. All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal 3/4 inch hardwood.

b. Standing or running trim casework components, which are specified to receive a transparent finish, shall be oak hardwood species, plain sawn. AWI grade shall be premium. Location, shape, and dimensions shall be as indicated on the drawings.

2.1.2 Panel Products

2.1.2.1 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in CPA A208.2.

2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section 06 61 16 SOLID POLYMER (SOLID SURFACING) FABRICATIONS.

2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of ANSI/NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on the drawings. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 5 by 7 inches in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 0.048 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

2.3.3 Horizontal General Purpose Postformable (HGP) Grade

Horizontal general purpose postformable grade plastic laminate shall be 0.042 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

2.3.4 Vertical General Purpose Postformable (VGP) Grade

Vertical general purpose postformable grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of components where postforming is required for curved surfaces.

2.3.5 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.020 inches in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

2.3.6 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.020 inches. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for casework cabinet interior and drawer interior surfaces.

2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be 0.020 inch thick. Material width shall be as indicated on the drawings. Color and pattern shall match exposed door and drawer front laminate pattern and color.

2.6 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include hinges, pulls, drawer glides. All hardware shall conform to ANSI/BHMA A156.9, unless otherwise noted, and shall consist of the following components:

a. Door Hinges: 5 knuckle wrap around type, 26D dull chrome finish, unless specified otherwise.

b. Cabinet Pulls: Wire pull type, satin stainless steel finish, unless specified otherwise.

c. Drawer Slide: Side mounted type, 26D dull chrome finish with full extension and a minimum 100 pound load capacity. Slides shall include an integral positive stop to avoid accidental drawer removal.

d. Adjustable Shelf Support System:

(1) Recessed (mortised) metal standards, BHMA No. BO4071, finish: 26D. Support clips for the standards shall be closed type, BHMA No. B04081, finish: satin.

2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F 547 where applicable.

2.8 ADHESIVES, CAULKS, AND SEALANTS

2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use polyvinyl acetate resin emulsion. Adhesives shall withstand a bond test as described in WDMA I.S. 1-A.

2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be adhesive consistent with AWI and laminate manufacturer's recommendations. PVC edgebanding shall be adhered using a polymer-based hot melt glue.

2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

2.9 WOOD FINISHES

Paint, stain, varnish and their applications required for laminate clad casework components shall be as indicated in Section 09 90 00 PAINTS AND COATINGS. Color and location shall be as indicated on the drawings.

2.10 ACCESSORIES

2.10.1 Grommets

Grommets shall be plastic material for cutouts with a diameter of 2 inches. Locations shall be as indicated on the drawings.

2.11 FABRICATION

Verify field measurements as indicated in the shop drawings before fabrication. Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI premium grade unless otherwise indicated in this specification. Cabinet style, in accordance with AWI Qual Stds, Section 400-G descriptions, shall be as indicated on the drawings.

2.11.1 Base and Wall Cabinet Case Body

2.11.1.1 Cabinet Components

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

a. Body Members (Ends, Divisions, Bottoms, and Tops): 3/4 inch veneer core plywood panel product.

b. Face Frames and Rails: 3/4 inch hardwood lumber.

c. Shelving: 3/4 inch medium density fiberboard (MDF) panel product.

d. Cabinet Backs: 1/4 inch veneer core plywood panel product.

e. Drawer Sides, Backs, and Subfronts: 1/2 inch panel product.

f. Drawer Bottoms: 1/4 inch veneer core plywood panel product.

g. Door and Drawer Fronts: 3/4-inch medium density fiberboard (MDF) panel product.

2.11.1.2 Joinery Method for Case Body Members

a. Tops, Exposed Ends, and Bottoms.

(1) Steel "European" assembly screws (1-1/2 inch from end, 5 inch on center, fasteners will not be visible on exposed parts).

(2) Doweled, glued under pressure (approx. 4 dowels per 12 inches of joint).

(3) Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).

b. Exposed End Corner and Face Frame Attachment.

(1) For mitered joint: lock miter or spline or biscuit, glued under pressure (no visible fasteners).

(2) For non-mitered joint (90 degree): butt joint glued under pressure (no visible fasteners).

c. Cabinet Backs (Wall Hung Cabinets): Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

(1) Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.

d. Cabinet Backs (Floor Standing Cabinets).

(1) Side bound, captured in grooves; glued and fastened to top and bottom.

e. Wall Anchor Strips shall be required for all cabinets with backs less than 1/2 inch thick. Strips shall consist of minimum 1/2 inch thick lumber, minimum 2-1/2 inches width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

2.11.2 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from 3/4 inch medium density fiberboard (MDF. All door and drawer front edges shall be surfaced with high pressure plastic laminate, color and pattern to match exterior face laminate as indicated on the drawings.

2.11.3 Drawer Assembly

2.11.3.1 Drawer Components

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

b. Drawer Sides and Backs For Laminate Finish: 1/2 inch thick 7-ply hardwood veneer core substrate.

c. Drawer Sides and Back For Thermoset Decorative Overlay (melamine) Finish: 1/2 inch thick medium density particleboard or MDF fiberboard substrate.

d. Drawer Bottom: 1/4 inch thick thermoset decorative overlay melamine panel product.

2.11.3.2 Drawer Assembly Joinery Method

a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.

b. Doweled, glued under pressure.

2.11.4 Shelving

2.11.4.1 General Requirements

Shelving shall be fabricated from 3/4 inch medium density fiberboard MDF. All shelving top and bottom surfaces shall be finished with HPDL plastic laminate or thermoset decorative overlay (melamine). Shelf edges shall be finished in a HPDL plastic laminate or thermoset decorative overlay (melamine).

2.11.4.2 Shelf Support System

The shelf support system shall be:

a. Recessed (mortised) metal shelf standards. Standards shall be mortised flush with the finishes surface of the cabinet interior side walls, two per side. Standards shall be positioned and spaced on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Standards shall be installed and adjusted vertically to provide a level, stable shelf surface when clips are in place.

2.11.5 Laminate Clad Countertops

Laminate countertop substrate shall be constructed of 3/4 inch medium density fiberboard (MDF). The substrate shall be moisture-resistant where countertops receive sinks, lavatories, or are subjected to liquids. All substrates shall have sink cutout edges sealed with appropriate sealant against moisture. No joints shall occur at any cutouts. A balanced backer sheet is required.

2.11.5.1 Edge Style

Front and exposed side countertop edges shall be in shapes and to dimensions as shown on the drawings. The countertop edge material shall be:

a. Post formed plastic laminate. Laminate edge shall be integral with countertop surface. Shape and profile shall be as indicated on the drawings and to dimensions as indicated on the drawings.

2.11.5.2 Laminate Clad Splashes

Countertop splash substrate shall be 3/4 inch MDF fiberboard. Laminate clad backsplash shall be loose, to be installed at the time of countertop installation. Side splashes shall be straight profile and provided loose, to be installed at the time of countertop installation. Back and side splash laminate pattern and color shall match the adjacent countertop laminate.

2.11.6 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and ANSI/NEMA LD 3, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

a. Base/Wall Cabinet Case Body.

(1) Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGP.

(2) Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: HPDL Grade CLS, Thermoset Decorative Overlay (melamine).

b. Adjustable Shelving.

(1) Top and bottom surfaces: HPDL Grade HGS.

(2) All edges: HPDL Grade VGS.

c. Fixed Shelving.

(1) Top and bottom surfaces: HPDL Grade HGS.

(2) Exposed edges: HPDL Grade VGS.

d. Door, Drawer Fronts, Access Panels.

(1) Exterior (exposed) and interior (semi-exposed) faces: HPDL Grade VGP

(2) Edges: HPDL Grade VGS.

e. Drawer Assembly.

All interior and exterior surfaces: HPDL Grade CLS, Thermoset Decorative Overlay (melamine).

f. Countertops and Splashes: All exposed and semi-exposed surfaces: HPDL Grade HGS

g. Tolerances: Flushness, flatness, and joint tolerances of laminated surfaces shall meet the AWI Qual Stds premium grade requirements.

2.11.7 Finishing

2.11.7.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

2.11.7.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

2.11.7.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings and Section 09 90 00 PAINTS AND COATINGS. All cabinet reveals shall be painted. Submit descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with AWI Qual Stds for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall comply with applicable requirements for AWI Qual Stds premium quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

3.1.1 Anchoring Systems

3.1.1.1 Floor

Base cabinets shall utilize a floor anchoring system. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abuts a wall surface, anchoring shall include a minimum 1/2 inch thick lumber or panel product hanging strip, minimum 2-1/2 inch width; securely attached to the top of the wall side of the cabinet back.

3.1.1.2 Wall

Cabinet to be wall mounted shall utilize minimum 1/2 inch thick lumber or panel product hanging strips, minimum 2-1/2 inch width; securely attached to the wall side of the cabinet back, both top and bottom.

3.1.2 Countertops

Countertops shall be installed in locations as indicated on the drawings. Countertops shall be fastened to supporting casework structure with mechanical fasteners, hidden from view. All joints formed by the countertop or countertop splash and adjacent wall surfaces shall be filled with a clear silicone caulk. Loose back and side splashes shall be adhered to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Joints between the countertop surface and splash shall be filled with clear silicone caulk in a smooth consistent concave bead. Bead size shall be the minimum necessary to fill the joint and any surrounding voids or cracks.

3.1.3 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 3/16 inch "Euroscrews". The use of wood screws without insertion dowels is prohibited.

3.1.4 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI Qual Stds premium grade requirements.

3.1.5 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.6 Glass

Install glass and glazing in the casework using methods and materials specified in Section 08 81 00 GLAZING in locations as indicated on the drawings.

-- End of Section --

SECTION 06 61 16

SOLID POLYMER (SOLID SURFACING) FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2583	(2007) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 570	(1998; R 2010e1) Standard Test Method for Water Absorption of Plastics
ASTM D 638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D 696	(2008) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 21	(2009) Determining Resistance of Synthetic Polymeric Materials to Fungi

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO Z124.3	(2005) Plastic Lavatories
IAPMO Z124.6	(2007) Plastic Sinks

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

NSF INTERNATIONAL (NSF)

NSF/ANSI 51	(2009e) Food Equipment Materials

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS Scientific Certification Systems (SCS)Indoor Advantage

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk (2010) Handbook for Ceramic Tile Installation

1.2 SYSTEM DESCRIPTION

a. Work under this section includes countertops, window stools, and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.

b. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.

c. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus 1/4 inch.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Solid polymer material
Fabrications

SD-04 Samples

Material;
Countertops;

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

1.6 WARRANTY

Provide manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

PART 2 PRODUCTS

2.1 MATERIAL

Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting IAPMO Z124.3 and IAPMO Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 1/4 inch in thickness. Submit a minimum 4 by 4 inch sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work.

2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4000 psi (min.)	ASTM D 638
Hardness	55-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303

1/4" sheet	36", 1/2 lb ball, no failure	
1/2" sheet	140", 1/2 lb ball, no failure	
3/4" sheet	200", 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.1% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	30 max	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.2 Acrylic-modified Polymer Solid Surfacing Material

Cast, solid polymer material shall be composed of a formulation containing acrylic and polyester polymers, mineral fillers, and pigments. Acrylic polymer content shall be not less than 5 percent and not more than 10 percent in order to meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4100 psi (min.)	ASTM D 638
Hardness	50-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4" sheet	36", 1/2 lb ball, no failure	
1/2" sheet	140", 1/2 lb	

	ball, no failure	
3/4" sheet	200", 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.6% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	100 max	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.3 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project color schedule. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.4 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting TCA Hdbk, Underwriter's Laboratories (UL) listed. Use this adhesive to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Use sealant to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 4 mils thick, applied around the edges of cut outs containing hot or cold appliances.

2.2.5 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

2.3.1 Joints and Seams

Form joints and seams between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Counter and Vanity Top Splashes

Fabricate backsplashes and end splashes from 3/4 inch thick solid surfacing material to be 4 inches high. Backsplashes and end splashes shall be provided for all counter tops. Backsplashes shall be shop fabricated and be permanently attached.

2.3.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition.

2.3.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Window Stools

Fabricate window stools from 3/4 inch thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings and selected from manufacturer's available pre-fabricated standards.

2.3.5 Countertops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 3/4 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high permanently attached, 90 degree transition. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

2.3.6 Solid Polymer Sinks

Solid polymer sinks shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer countertops. Sinks shall be of the same polymer composition as the adjoining counter top.Sink design shall support a seam adhesive undermount installation method. Sinks shall be a double bowl configuration. Sink dimensions shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.1.1 Loose Counter Top Splashes

Mount loose splashes in the locations noted on the drawings. Loose splashes shall be adhered to the counter top with a color matched silicone sealant when the solid polymer components are solid colors. Use a clear silicone sealant to provide adhesion of particulate patterned solid polymer splashes to counter tops.

3.1.2 Silicone Sealant

Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost.

-- End of Section --

SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4263	(1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4479	(2000) Asphalt Roof Coatings - Asbestos Free
ASTM D 449	(2003) Asphalt Used in Dampproofing and Waterproofing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction

1.2 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing manufacturer's original labels. Labels shall include date of manufacture, contents of each container, performance standards that apply to the contents and recommended shelf life.

1.3 SAFETY AND HEALTH REQUIREMENTS

If coal-tar pitch materials are used, the Contractor shall conform to all OSHA 29 CFR 1926 and General Industry Health Standards as well as state and local standards.

PART 2 PRODUCTS

2.1 ASPHALT

ASTM D 449, Type I or Type II.

2.2 ASPHALT PRIMER

ASTM D 41.

2.3 FIBROUS ASPHALT

ASTM D 4479, Type I for horizontal surfaces, Type II for vertical surfaces.

2.4 SURFACE PROTECTION

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with ASTM D 4263. If test indicates moisture, allow a minimum of 7 additional days after test completion for curing. If moisture still exists, redo test until substrate is dry.

3.2 APPLICATION

Prime surfaces to receive asphaltic dampproofing unless recommended otherwise by dampproofing materials manufacturer. Apply dampproofing after priming coat is dry, but prior to any deterioration of primed surface, and when ambient temperature is above 40 degrees F.

3.2.1 Surface Priming

Prime surfaces to receive fibrous asphalt dampproofing with asphalt primer. Apply primer when ambient temperature is above 40 degrees F and at rate of approximately one gallon per 100 square feet, fully covering entire surface to be dampproofed.

3.2.2 Cold-Application Method

Apply two coats of fibrous asphalt to surfaces to be dampproofed. Apply each coat uniformly using not less than one gallon fibrous asphalt per 50 square feet. Apply first coat by brush or spray to provide full bond with primed surface. Brush or spray second coat over thoroughly dry first coat unless recommended otherwise by dampproofing materials manufacturer. Provide finished surface that is of uniform thickness and impervious to moisture. Recoat porous areas.

-- End of Section --

SECTION 07 21 16 MINERAL

FIBER BLANKET INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2005) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 3833/D 3833M	(1996; R 2006) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM E 136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2009; TIA 10-3) National Fuel Gas Code
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket insulation;

Vapor retarder;

Pressure sensitive tape

Accessories

SD-08 Manufacturer's Instructions

Insulation

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Smoking

Do not smoke during installation of blanket thermal insulation.

1.5.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C665, Type I, blankets without membrane coverings ; Class A, membrane-faced surface with a flame spread of 25 or less, except a flame spread rating of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84.

2.1.1 Thermal Resistance Value (R-VALUE)

As indicated

2.1.2 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section. The minimum required recycled materials content by weight are:

Rock Wool: 75 percent slag
Fiberglass: 20 to 25 percent glass cullet

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

2.2 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E 136 for blocking around chimneys and heat producing devices.

2.3 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D 3833/D 3833M.

2.4 ACCESSORIES

2.4.1 Adhesive

As recommended by the insulation manufacturer.

2.4.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.4.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.

b. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

c. Gas Fired Appliances: Clearances as required in NFPA 54.

d. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E 136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

3.3.1.5 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

-- End of Section --

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1289	(2007) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 208	(1995; R 2001) Cellulosic Fiber Insulating Board
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2005) Approval Guide
FM P7825c	(2005) Approval Guide Building Materials
FM P9513	(2002) Specialist Data Book Set for Roofing Contractors; contains 1-22 (2001), 1-28 (2002), 1-29 (2002), 1-28R/1-29R (1998), 1-30 (2000), 1-31 (2000), 1-32 (2000), 1-33 (2000), 1-34 (2001), 1-49 (2000), 1-52 (2000), 1-54 (2001)

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2007) Building Materials Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wood nailers

Tapered roof insulation system;

Show location and spacing of wood nailers that are required for securing insulation and for backnailing of roofing felts. Show a complete description of the procedures for the installation of each phase of the system indicating the type of materials, thicknesses, identity codes, sequence of laying insulation, location of ridges and valleys, special methods for cutting and fitting of insulation, and special precautions. The drawings shall be based on field measurements.

SD-03 Product Data

Fasteners

Insulation;

Include minimum thickness of insulation for steel and concrete decks and fastener pattern for insulation on steel decks.

SD-06 Test Reports

Flame spread and smoke developed ratings

Submit in accordance with ASTM E 84.

SD-07 Certificates

Installer qualifications

SD-08 Manufacturer's Instructions

Nails and fasteners

Roof insulation, including field of roof and perimeter attachment requirements.

1.3 MANUFACTURER'S CERTIFICATE

Submit certificate from the insulation manufacturer attesting that the installer has the proper qualifications for installing tapered roof insulation systems.

Certificate attesting that the polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.4 QUALITY ASSURANCE

1.4.1 Insulation on Steel Decks

Roof insulation shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when

tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Bld Mat Dir as meeting the flame spread and smoke developed ratings will be accepted in lieu of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Bld Mat Dir or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials to site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

a. Name of manufacturer;

b. Brand designation;

c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification; and

d. Asphalt's flashpoint (FP), equiviscous temperature (EVT), and finished blowing temperature (FBT).

Deliver materials in sufficient quantity to allow continuity of the work.

1.5.2 Storage and Handling

Store and handle materials in a manner to protect from damage, exposure to open flame or other ignition sources, and from wetting, condensation or moisture absorption. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Store felt rolls on ends. For the 24 hours immediately before application of felts, store felts in an area maintained at a temperature no lower than 50 degrees F above grade and having ventilation around all sides. Replace damaged material with new material.

1.6 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

1.7 PROTECTION OF PROPERTY

1.7.1 Flame-Heated Equipment

Locate and use flame-heated equipment so as not to endanger the structure or other materials on the site or adjacent property. Do not place flame-heated equipment on the roof. Provide and maintain a fire extinguisher near each item of flame-heated equipment.

1.7.2 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings at least 6 inches, secure them against wind, and vent them to prevent collection of moisture on the covered surfaces. Keep protective coverings in place for the duration of the work with asphalt products.

1.7.3 Special Protection

Provide special protection approved by the insulation manufacturer, or avoid heavy traffic on completed work when ambient temperature is above 80 degrees F.

1.7.4 Drippage of Bitumen

Seal joints in and at edges of deck as necessary to prevent drippage of asphalt into building or down exterior walls.

PART 2 PRODUCTS

2.1 INSULATION

2.1.1 Insulation Types

Roof insulation shall be of the following materials and compatible with attachment methods for the specified insulation and roof membrane:

a. Polyisocyanurate Board: ASTM C 1289 Type II, Class 1 or 2, Grade 2 or 3 fibrous felt or glass mat membrane both sides, except minimum compressive strength shall be 20 pounds per square inch (psi).

ASTM C 208 Type II, Grade 1 or 2, roof insulating overlay/cover board, treated with sizing, wax or bituminous impregnation. Bituminous impregnation shall be limited to 4 percent by weight when used over steel decks. Maximum board size: 4 feet by 4 feet.

2.1.2 Recovered Materials

Provide thermal insulation materials containing recycled materials to the extent practical. The required minimum recycled material content for the listed materials are:

Polyisocyanurate: 9 percent recovered material

2.1.3 Insulation Thickness

As necessary to provide a thermal resistance (R value) of 30 or more at metal roof panels except for exterior canopies. Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

2.1.4 Tapered Roof Insulation

One layer of the tapered roof insulation assembly shall be factory tapered to a slope of not less than 1/4 inch per foot. Provide starter and filler blocks as required to provide the total thickness of insulation necessary to meet the specified slope and thermal conductance. Mitered joints shall be factory fabricated and shall consist of two diagonally cut boards or one board shaped to provide the required slopes. Identify each piece of tapered

insulation board by color or other identity coding system, allowing the identification of different sizes of tapered insulation board required to complete the roof insulation system.

2.1.5 Cants and Tapered Edge Strips

Provide preformed cants and tapered edge strips of the same material as the roof insulation; or, when roof insulation material is unavailable, provide pressure-preservative treated wood, wood fiberboard, or rigid perlite board cants and edge strips as recommended by the roofing manufacturer, unless otherwise indicated. Face of cant strips shall have incline of 45 degrees and vertical height of 4 inches. Taper edge strips at a rate of one to 1 1/2 inch per foot down to approximately 1/8 inch thick.

2.2 PROTECTION BOARD

For use as a thermal barrier (underlayment), fire barrier (overlayment), or protection board for hot-mopped, torched-down, or adhesively-applied roofing membrane over roof insulation.

2.2.1 Fiberboard

a. Wood Fiberboard: ASTM C 208, high density, except 4 by 4 feet maximum board size.

2.3 BITUMENS

2.3.1 Asphalt Primer

ASTM D 41.

2.3.2 Asphalt

ASTM D 312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and for mechanical spreader application shall be indicated on bills of lading or on individual containers.

2.3.3 Asphalt Roof Cement

ASTM D 4586, Type I for horizontal surfaces and for surfaces sloped from 0 to 3 inches per foot, Type II for vertical and surfaces sloped more than 3 inches per foot.

2.4 FASTENERS

Flush-driven through flat round or hexagonal steel or plastic plates. Steel plates shall be zinc-coated, flat round not less than 1 3/8 inch diameter or hexagonal not less than 28 gage. Plastic plates shall be high-density, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fastener head shall recess fully into the plastic plate after it is driven. Plates shall be formed to prevent dishing. Do not use bell-or cup-shaped plates.

2.4.1 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws conforming to FM AS 4470 and listed in FM P7825c for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of 90 psf conforming to FM P7825.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

3.1.1 Surface Inspection

Surfaces shall be clean, smooth, and dry. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The Contractor shall inspect and approve the surfaces immediately before starting installation. Prior to installing insulation, perform the following:

a. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.

3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage and hollow or low spots and perform the following:

a. Install wood nailers the same thickness as insulation at eaves, edges, curbs, walls, and roof openings for securing cant strips, gravel stops, gutters, and flashing flanges. On decks with slopes of one inch per foot or more, install wood nailers perpendicular to slope for securing insulation. Space nailers in accordance with approved shop drawings.

b. Cover steel decks with a layer of insulation board of sufficient thickness to span the width of a deck rib opening, and conforming to fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement conforming to FM P7825. Insulation joints parallel to ribs of deck shall occur on solid bearing surfaces only, not over open ribs.

3.2 INSULATION INSTALLATION

Apply insulation in multiple layers with staggered joints when total required thickness of insulation exceeds 2 inches. Lay insulation so that continuous longitudinal joints are perpendicular to direction of roofing, as specified in Section 07 52 00, "MODIFIED BITUMINOUS MEMBRANE ROOFING", and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, joints of each succeeding layer shall be parallel and offset in both directions with respect to layer below. Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface.

3.2.1 Special Precautions for Installation of Foam Insulation

3.2.1.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, mechanically fasten bottom 1 1/2 inch insulation layer max. board size = 4'x8". Provide bottom layer compliant with manufacturer's requirements for uplift indicated. Adhere upper layer(s), max. board size = 4'x4". Install 1/2 inch thick wood fiberboard over top surface of foam board insulation where modified bitumen roof membrane systems are to be installed. Stagger joints of insulation with respect to foam board insulation below.

3.2.2 Cant Strips

Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof. Wood cant strips shall bear on and be anchored to wood blocking. Fit cant strips flush against vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install in an adhesive approved by insulation manufacturer.

3.2.3 Tapered Edge Strips

Where indicated, provide edge strips in the right angle formed by junction of roof and wood nailing strips that extend above level of roof. Install edge strips flush against vertical surfaces of wood nailing strips. Where possible, nail edge strips to adjoining surfaces. Where installed against non-nailable materials, install in an adhesive approved by insulation manufacturer.

3.3 PROTECTION

3.3.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with the finished roofing specified in Modified Bituminous Membrane Roofing on same day. Do not permit phased construction. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight to conform to indicated live load limits of roof construction. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent.

3.3.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

3.4 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with FM P9513.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION 07 24 00

EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2009) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C1177/C1177M	(2008) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1186	(2008) Standard Specification for Flat Non-Asbestos Fiber Cement Sheets
ASTM C1278/C1278M	(2007a) Standard Specification for Fiber-Reinforced Gypsum Panel
ASTM C473	(2010) Physical Testing of Gypsum Panel Products
ASTM C578	(2011) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C67	(2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C847	(2010a) Standard Specification for Metal Lath
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 2247	(2011) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	(2000; R 2005) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D 968	(2005; R 2010) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 2098	(2000; R 2006) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and

	Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 695	(2003; R 2009) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 153	(2004; R 2010) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)

EIMA TM 101.01	(1995) Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS), Class PB
EIMA TM 101.86	(1995) Resistance of Exterior Insulation Finish Systems (EIFS), Class PB to The Effects of Rapid Deformation (Impact)

INTERNATIONAL CODE COUNCIL (ICC)

ICC UBC	(1997; Erratas Vol 1, 2 & 3 01/2001; Vol 1 & 2 03/2001; Vol 2 10/2001) Uniform Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268	(2007) Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of sheathing, insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components shall be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials shall be installed by an applicator approved by the system manufacturer. EIFS shall be Class PB as indicated and shall be color and finish as indicated.

1.2.1 System Requirements and Tests

The system shall meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E 331. There shall be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.4 psf, or 20 percent of positive design wind pressure, whichever is greater.

1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with ASTM E 330 (procedure A) to a minimum pressure of 45 psf. There shall be no permanent deformation, delamination, or other deterioration.

1.2.1.3 Full scale or intermediate scale fire test

Conduct wall fire test using apparatus, specimen, performance criteria, and procedure in accordance with ICC UBC, Chapter 26-4. The specimen shall include the complete system using 4 inch thick insulation board. At the option of the contractor, ICC UBC, Chapter 26-9, Intermediate-Scale Test may be substituted in lieu of the Full-Scale Multi- Story Fire test. The following requirements shall be met:

a. No vertical spread of flame within core of panel from one story to the next.

b. No flame spread over the exterior surface.

c. No vertical flame spread over the interior surface from one story to the next.

d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

1.2.2 Component Requirements and Tests

The components of the system shall meet the performance requirements as verified by the tests listed below.

1.2.2.1 Surface Burning Characteristics

Conduct ASTM E 84 test on samples consisting of base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index shall be 25 or less and the smoke developed index shall be 450 or less.

1.2.2.2 Radiant Heat

The system shall be tested in accordance with NFPA 268 on both the minimum and maximum thickness of insulation intended for use with no ignition during the 20-minute period.

1.2.2.3 Impact Resistance

a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with EIMA TM 101.86. The test specimen shall exhibit no broken reinforcing fabric per EIMA TM 101.86 at an impact of 150 in/lb.

b. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with ASTM E 695. The test specimen shall exhibit no cracking or denting after twelve impacts by 30 lbs lead shot mass from 6 in to 6 ft drop heights in 6 in intervals.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building. For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D 968, Method A. Test a minimum of two specimens. After testing, the specimens shall show only very slight smoothing, with no loss of film integrity after 132 gallons of sand.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G 153, Cycle 1. After 2000 hours specimens shall exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D 3273. The specimen shall consist of the finish coat material, applied to clean 3 inch by 4 inch glass slides and shall be allowed to cure for 28 days. After 28 days of exposure, the specimen shall not show any growth.

1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B117. The specimen shall be a minimum of 4 inch by 6 inch and shall be tested for a minimum of 300 hours. After exposure, the specimen shall exhibit no observable deterioration, such as chalking, fading, or rust staining.

1.2.3.5 Water Resistance

Test in accordance with ASTM D 2247. The specimen shall be a minimum of 4 inch by 6 inch. After 14 days, the specimen shall exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.6 Absorption-Freeze/Thaw

Class PB systems shall be tested in accordance with EIMA TM 101.01 for 60 cycles of freezing and thawing. No cracking, checking, or splitting, and

negligible weight gain. Class PM systems shall be tested in accordance with ASTM C67 for 50 cycles of freezing and thawing. After testing, the specimens shall exhibit no cracking or checking and have negligible weight gain.

1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component 12 by 24 inches, on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

1.2.4 Moisture Analysis

Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop drawings;

Show wall layout, construction and expansion joints, decorative grooves, layout of sheathing board, thermal insulation board, and reinforcing mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; details at windows and or doors; and details at base, roof and corners.

SD-03 Product Data

Sheathing board;

Thermal insulation;

Mechanical Fasteners;

Reinforcing fabric

Finish coat

Joint Sealant

Sealant Primer

Bond breaker

Backer Rod

Insulation Board

Warranty

Include joint and other details, such as end conditions, corners, windows, and parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include material safety data sheets (MSDS)for all components of the EIFS. The MSDS shall be available at the job site.

SD-04 Samples

Sample Boards;

Color and Texture

SD-05 Design Data

Wind load Calculations;

SD-06 Test Reports

Abrasion resistance

Accelerated weathering

Impact resistance

Mildew resistance Salt

spray resistance

Water vapor transmission

Absorption-freeze-thaw

Wall fire test

Water penetration

Water resistance

Surface Burning Characteristics

Radiant heat

Wind load

SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of EIFS Manufacturer

The EIFS shall be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

The EIFS Installer shall be trained by the EIFS manufacturer to perform the installation of the System and shall have successfully installed at least five projects at or near the size and complexity of this project. The contractor shall employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator shall be experienced and competent in the installation of high performance industrial and commercial sealants and shall have successfully installed at least five projects at or near the size and complexity of this project.

1.4.5 Insulation Board

Insulation Board shall be approved and labeled under third party quality program as required by applicable building code.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

1.6 ENVIRONMENTAL CONDITIONS

a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.

b. Apply sealants and wet materials only at ambient temperatures of 40 degrees F or above and rising, unless supplemental heat is provided. The system shall be protected from inclement weather and to maintain this temperature for a minimum of 24 hours after installation.

c. Do not leave insulation board exposed to sunlight after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty shall run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 SHEATHING BOARD

2.2.1 Fiber Reinforced Cement Sheathing Board

a. Meet ASTM C1186, Type A, Grade I.

b. Non-combustible per ASTM E 136.

c. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

d. Thickness no less than 1/2 inch.

e. Water Absorption not to exceed 17 percent.

2.2.2 Glass Mat Gypsum Sheathing Board

a. Conform to ASTM C1177/C1177M; or.

b. ASTM C1278/C1278M, Water Resistant Exterior Type only

c. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

2.3 ADHESIVE

Manufacturer's standard product, including primer as required, and shall be compatible with substrate and insulation board to which the system is applied.

2.4 LATHING AND FURRING

Conform to ASTM C847, 2.5 lb/sq yd, self-furring, galvanized.

2.5 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.6 THERMAL INSULATION

2.6.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

2.6.2 Insulation Board

Insulation board shall be standard product of manufacturer and shall be compatible with other systems components. Boards shall be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degree F, and thickness. No layer of insulation shall be less than 3/4 inch thick. The maximum thickness of all layers shall not exceed 4 inches Insulation Board shall be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

a. Thermal resistance: As indicated

b. Insulating material: ASTM C578 Type I as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.

c. Drainage: Preform channels into the interior face of insulation board or provide polypropylene drainage lath spacer to provide water drainage system.

2.7 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.8 REINFORCING FABRIC

Reinforcing fabric mesh shall be alkali-resistant, balanced, open weave , glass fiber fabric made from twisted multi-end strands specifically treated

for compatibility with the other system materials, and comply with ASTM E 2098 and as recommended by EIFS manufacturer.

2.9 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

2.10 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.11 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, expansion joints. All metal items and fasteners to be corrosion resistant.

2.12 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C920, as Type S or M, minimum Grade NS, minimum Class 25 and compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.13 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.14 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface shall be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate shall be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge.Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation

instructions but provide a flatness of not more that 1/4 inch in 10 feet. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor shall not proceed with the installation until all noted deficiencies of the substrate are corrected.

3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS shall be installed only by an applicator trained by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations.

3.3.1 Sheathing Board

Edges and ends of boards shall be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board to metal panels and girts with self-tapping drywall screws. Place fasteners sufficiently close to support imposed loads, but not more than:

a. Maximum of 8 inches apart on each supporting stud

Space fasteners more closely when required for negative wind load resistance.

3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least 8 inches. Align drainage channels of integral drainage system or provide polypropylene drainage lath space to provide a path for any water weeped from behind the insulation to escape wall construction. Use L-shaped insulation board pieces at corners of openings. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Gaps greater than 1/16 inch between the insulation boards shall be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than 1/16 inch shall be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board shall be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

3.3.2.1 Mechanically Fastened Insulation Boards

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 2 feet horizontally and vertically.

3.3.2.2 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer's instructions.

3.3.3 Base Coat and Reinforcing Fabric Mesh,

3.3.3.1 Class PB Systems

Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with manufacturer's instructions. Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh shall not be visible. Provide diagonal reinforcement at opening corners. Back-wrap or edge wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 2.5 inches on previously installed mesh, or butted, in accordance with the manufacturer's instructions.

3.3.4 Finish Coat

The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., shall be corrected prior to the application of the finish coat. Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved sample. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat shall be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied.

3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat or base coat with EIFS Manufacturer's color coating. Do not apply sealant to the finish coat.

3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 0.5 inch for perimeter seals and 0.75 inch for expansion joints. The width shall not be less than 4 times the anticipated movement. Check

sealant manufacturer's recommendations regarding proper width to depth ratio.

3.4.2 Sealant

Do not apply sealant until all EIFS coatings are fully dry. Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or can not be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor shall establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance shall be removed and replaced or corrected in an approved manner.

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

SECTION 07 41 13

METAL ROOF PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341	(2005; Supp 2001) Seismic Provisions for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002) Cold-Formed Steel Design Manual Set
AISI/COS/NASPEC	(2001, Supplement 2004) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7-05	(2006) Minimum Design Loads for Buildings and Other Structures, Including Supplement No. 1

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M	(2004; Errata 2004) Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2006; Errata 2006) Structural Welding Code - Steel
AWS D1.2/D1.2M	(2003; Errata 2004) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M	(2007a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel

ASTM A 653/A 653M	(2007) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 755/A 755M	(2003) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A 792/A 792M	(2006a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A 924/A 924M	(2007) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 792	(2004) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1308	(2002; R 2007) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1667	(2005) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 1970	(2001) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D 2244	(2007) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2447	(2003) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter

ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 3363	(2005) Film Hardness by Pencil Test
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	(2005) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Standard Test Method for Specular Gloss
ASTM D 5894	(2005) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(2007) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002e1) Evaluating Degree of Blistering of Paints
ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 968	(2005e1) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 2140	(2001) Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

FM GLOBAL (FM)

FM 4471	(1995) Class I Panel Roofs

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA RSDM	(2000) Metal Roofing Systems Design Manual

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0405	(2001; R 2003, 5th Ed) Roofing and Waterproofing Manual
NRCA ASMMRM	(2006) Architectural Sheet Metal and Metal Roofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2006) Architectural Sheet Metal Manual, Sixth Edition, Second Printing

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 12	(1982; E 2000) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-28578	(Rev B; CANC Notice 1) Paint, Water-Borne, Acrylic or Modified Acrylic, Semi-Gloss, for Metal Surfaces

UNDERWRITERS LABORATORIES (UL)

UL 580	(2006) Tests for Uplift Resistance of Roof Assemblies
UL Bld Mat Dir	(2007) Building Materials Directory

1.2 DESCRIPTION OF METAL ROOF SYSTEM

1.2.1 Performance Requirements

Steel panels and accessory components must conform to the following standards:

ASTM A 1008/A 1008M
ASTM A 123/A 123M
ASTM A 36/A 36M
ASTM A 755/A 755M for metallic coated steel sheet for exterior coil prepainted applications.
ASTM A 924/A 924M for metallic coated steel sheet
ASTM D 522 for applied coatings
UL Bld Mat Dir

1.2.1.1 Hydrostatic Head Resistance

No water penetration when tested according to ASTM E 2140. Submit leakage test report upon completion of installation.

1.2.1.2 Wind Uplift Resistance

Provide metal roof panel system that conform to the requirements of ASTM E 1592 and UL 580. Uplift force due to wind action governs the design for panels. Submit wind uplift test report prior to commencing installation.

Roof system and attachments must resist the wind loads as determined by ASCI/SEI 7-05, in pounds per square foot. Metal roof panels and component materials must also comply with the requirements in FM 4471 as part of a panel roofing system as listed in Factory Mutual Guide (FMG) "Approval Guide" for class 1 or noncombustible construction, as applicable. Identify all materials with FMG markings.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing Panels;

Flashing and Accessories;

Gutter/Downspout Assembly;

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Roof panels;

FACTORY-APPLIED COLOR FINISH;

Accessories;

Fasteners;

Pressure Sensitive Tape;

UNDERLAYMENTS; ice and water shield

Gaskets and Sealing/Insulating Compounds;

Enamel Repair Paint;

Galvanizing Repair Paint; G

SD-04 Samples

Roof Panels;

Factory-applied Color Finish, samples, 9 inch lengths, full width;

Accessories;

Fasteners;

Gaskets and Sealant/Insulating Compounds;

SD-05 Design Data

Wind Uplift Resistance;

SD-06 Test Reports

Leakage Test Report;

Wind Uplift Test Report;

Fire Rating Test Report;

Factory Finish and Color Performance Requirements;

SD-07 Certificates

Roof Panels;

Self-Adhering Polyethylene Film Ice and Water Shield Underlayment;

Qualification of Manufacturer;

Qualification of Applicator;

SD-08 Manufacturer's Instructions

INSULATION;

INSTALLATION MANUAL;

SD-09 Manufacturer's Field Reports

Manufacturer's Field Inspection Reports;

SD-11 Closeout Submittals

Warranties;

Information Card;

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

Submit documentation verifying metal roof panel manufacturer has been in the business of manufacturing metal roof panels for a period of not less than 5 years.

Manufacturer must also provide engineering services by an authorized engineer, currently licensed in the geographic area of the project, with a minimum of five (5) years experience as an engineer knowledgeable in roof wind design analysis, protocols and procedures for MBMA RSDM, ASCE/SEI 7-05, UL 580, and FM 4471. Engineer must provide certified engineering calculations for the project conforming to the stated references.

1.4.1.1 Manufacturer's Technical Representative

The manufacturer's technical representative must be thoroughly familiar with the products to be installed, installation requirements and practices, and with any special considerations in the geographical area of the project. The representative must perform field inspections and attend meetings as specified.

1.4.1.2 Single Source

Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer, and the most recent design of the manufacturer to operate as a complete system for the intended use.

1.4.2 Qualification of Applicator

Metal roof system applicator must be approved, authorized, or licensed in writing by the roof panel manufacturer and have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer, approved at a level capable of providing the specified warranty. Supply the names, locations and client contact information of 5 projects of similar size and scope constructed by applicator using the manufacturer's roofing products submitted for this project within the previous three years.

1.4.3 Field Verification

Prior to the preparation of drawings and fabrication, verify location of roof framing, roof openings and penetrations, and any other special conditions. Indicate all special conditions and measurements on final shop drawings.

1.4.4 Qualifications for Welding Work

Welding procedures must conform to AWS D1.1/D1.1Mfor steel or AWS D1.2/D1.2M for aluminum.

Operators are permitted to make only those types of weldments for which each is specifically qualified.

1.4.5 Pre-roofing Conference

After approval of submittals and before performing roofing system installation work, hold a pre-roofing conference to review the following:

a. Drawings, specifications, and submittals related to the roof work. Submit, as a minimum; sample profiles of roofing panels, with factory-applied color finish samples, flashing and accessories, gutter/downspout assembly samples, typical fasteners and pressure sensitive tape, sample gaskets and sealant/insulating compounds. Also include data and 1/2 pint sample of enamel repair paint and galvanizing repair paint, and technical data on factory formed panels, and manufacturer's installation manual.

b. Roof system components installation;

c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;

d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

e. Quality control plan for the roof system installation;

f. Safety requirements.

Coordinate pre-roofing conference scheduling with the Contracting Officer. Attendance is mandatory for the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of metal roof system, flashing and sheet metal work, mechanical and electrical work, other trades interfacing with the roof work, and representative of the metal roofing manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.5 DELIVERY, HANDLING, AND STORAGE

Deliver, store, and handle panel materials, bulk roofing products, accessories, and other manufactured items in a manner to prevent damage and deformation, as recommended by the manufacturer, and as specified.

1.5.1 Delivery

Package and deliver materials to the site in undamaged condition. Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use, except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, deformation, dampness, and staining.Remove affected materials from the site and immediately replace.. Remove moisture from wet materials not otherwise affected, restack and protect from further moisture exposure.

1.5.2 Handling

Handle materials in a manner to avoid damage. Select and operate material handling equipment so as not to damage materials or applied roofing.

1.5.3 Storage

Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering which prevents trapping of water or condensation under the covering. Store roof panels so that water which may have accumulated during transit or storage will drain off. Do not store panels in contact with materials that might cause staining. Secure coverings and stored items to protect from wind displacement.

1.6 PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit metal roof panel work to be performed

according to manufacturer's written instructions and warranty requirements, and specified safety requirements.

1.7 FABRICATION

Fabricate and finish metal roof panels and accessories on a factory stationary industrial type rolling mill to the greatest extent possible, per manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements. Comply with indicated profiles, dimensional and structural requirements.

Provide panel profile, as indicated on drawings including major ribs for full length of panel. Fabricate panel side laps with factory installed captive gaskets or separator strips providing a weather tight seal and preventing metal-to metal contact, and minimizing noise from movements within the panel assembly.

1.7.1 Finishes

Finish quality and application processes must conform to the related standards specified within this section. Noticeable variations within the same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize any contrasting variations.

1.7.2 Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 as applicable to the design, dimensions, metal, and other characteristics of the item indicated.

a. Form exposed sheet metal accessories which are free from excessive oil canning, buckling, and tool marks, and are true to line and levels indicated, with exposed edges folded back to form hems.

b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

c. Sealed Joints: Form non-expansion, but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA 1793.

d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

e. Fabricate cleats and attachments devices of size and metal thickness recommended by SMACNA or by metal roof panel manufacturer for application, but not less than the thickness of the metal being secured.

1.8 WARRANTIES

Provide metal roof system material, weather tightness and workmanship warranties meeting specified requirements. Provide revision or amendment to manufacturer's standard warranty as required to comply with the specified requirements.

1.8.1 Metal Roof Panel Manufacturer Warranty

Furnish the metal roof panel manufacturer's 20-year roof system materials and installation workmanship warranty, including flashing, insulation, components, trim, and accessories necessary for a watertight roof system construction. Make warranty directly to the Government, commencing at time of Government's acceptance of the roof work. The warranty must state that:

a. If within the warranty period, the metal roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-weathertight, shows evidence of moisture intrusion within the assembly, displaces, corrodes, perforates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the metal roof system and correction of defective workmanship is the responsibility of the metal roof panel manufacturer. All costs associated with the repair or replacement work are the responsibility of the metal roof panel manufacturer.

b. If the manufacturer or his approved applicator fail to perform the repairs within 48 hours of notification, emergency temporary repairs performed by others does not void the warranty.

1.8.2 Weathertightness Warranty

Metal roof system manufacturer shall submit, for Government review and acceptance, a specimen copy of the manufacturer's Weathertightness Warranty, including evidence of application for warranty and manufacturer's acceptance of the applicator and warranty conditions. Warranty shall be a Single-Source Warranty. The specified warranty requirements and conditions are required to be satisfied, regardless of the manufacturer's standard warranty language or preferences. Roofing payments will be subject to additional withholdings at the Government's discretion pending provision of acceptable executed roofing manufacturer's and Contractor's roofing warranties.

Single Source Warranty: Single Source Warranties require a certified installer on site at all times:

a. For a period of twenty (20) years from the date of substantial completion, the roofing manufacturer WARRANTS to the Building Owner (Owners): to furnish roof panels, flashing and related items used to fasten the roof panels, and flashing including roof jack and curb attachments to the roof structure, will not allow intrusion of water from the exterior of the roofing manufacturer's Roof System into the building envelope when exposed to wind and weather conditions, excluding tornado or hurricane conditions, and ordinary wear and usage. The date of substantial completion is the date that is certified by the Owner's Representative, when the roofing manufacturer's Roofing System is complete and accepted by the Owner. Roofing will not be accepted, nor will any warranty commence, so long as the original roofing installation is not made watertight.

2. Manufacturer's Field Service

a. During installation, provide a minimum of two on-site inspections of roof application by qualified technical representative of the manufacturer.

b. Upon completion of installation, provide final written inspection report by a technical representative of roofing manufacturer to confirm that roofing system has been installed in accordance with manufacturer's requirements.

3. The roofing manufacturer shall have the SOLE AND EXCLUSIVE obligation for all warranty work commencing on the date of roofing substantial completion and under all circumstances terminates on the twenty (20) year anniversary of the date certified as Substantial Completion of the roofing manufacturer's Roof System. During the period in which the roofing manufacturer has any warranty obligation, the roofing manufacturer shall take appropriate actions necessary to cause the non-performing portions of the Roof System to perform their proper functions.

4. Roofing Manufacturer's Liability:

The total liability of the roofing manufacturer under Single Source warranty is a no dollar limit of the manufacturers Roof System as invoiced to the roofing manufacturer's customer.

1.8.3 Manufacturer's Finish Warranty

Provide a manufacturer's 20 year warranty for the roofing system. Issue the warranty directly to the Government at the date of Government acceptance warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244. Installation of the roofing in a coastal environment shall not diminish or void the finish warranty.

1.8.4 Metal Roof System Installer Warranty

Provide roof system installer warranty for a period of not less than two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof panel installation, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Issue warranty directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials is the responsibility of the metal roof system installer. All costs associated with the repair or replacement work are the responsibility of the installer.

1.9 CONFORMANCE AND COMPATIBILITY

The entire metal roofing and flashing system must be in accordance with specified and indicated requirements, including wind resistance and seismic per AISC 341 requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the MBMA RSDM, NRCA 0405, the metal panel manufacturer's published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or

indicated requirements to the Contracting Officer for approval prior to installation.

1.10 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of English unit measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The English units for the measurements shown are as follows:

	PRODUCTS	ENGLISH UNITS
a.	Panels - vertical legs	16/18 inches 2 inches
b.	Screws	No. 14 No. 12
c.	Bolts	1/4 inch
d.	Studs	3/16 inch
e.	Fasteners	1/2 inch One inch
f.	Rivets	1/16 inch 1/8 inch

PART 2 PRODUCTS

2.1 ROOF PANELS

2.1.1 Steel Sheet Panels

Roll-form steel sheet roof panels to the specified profile, with fy = 22 gauge and depth as indicated.
Material must be plumb and true, and within the tolerances listed:

a. Aluminum-Zinc alloy coated steel sheet conforming to ASTM A 792/A 792M and AISI SG03-3.

b. Individual panels to have continuous length sufficient to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not a part of the panel profile and free from damage to the finish coating system.

c. Provide panels with thermal expansion and contraction consistent with the type of system specified, and the following profile.

d. Profile to be a 2 inch high standing seam, 16 or 18 inch coverage with mechanical crimping or snap-together seams with concealed clips and fasteners.

2.2 FACTORY FINISH AND COLOR PERFORMANCE REQUIREMENTS

All panels are to receive a factory applied polyvinylidene fluoride finish consisting of a baked topcoat with a manufacturer's recommended prime coat conforming to the following:

a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with an acid rinse, and thorough drying.

b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 + 0.05 mils. The prime coat must be oven cured prior to application of the finish coat.

c. Exterior Finish Coating: Apply the exterior finish coating over the primer by roll coating to a dry film thickness of 0.80 + 0.05 mils for a total dry film thickness of 1.00 +0.10 mils. This exterior finish coat must be oven-cured.

d. Interior finish coating: Apply a wash coat on the reverse side over primer by roll coating to a dry film thickness of 0.30 + 0.05 mils for a total dry fill thickness of 0.50 +0.10 mils. The wash coat must be oven cured.

e. Color: The exterior finish chosen from the manufacturer's standard color chart.

f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General: SSPC Paint 12, MIL-P-28578, ASTM D 5894, and ASTM D 4587.

Abrasion: ASTM D 968
Adhesion: ASTM D 3359
Chalking: ASTM D 4214
Chemical Pollution: ASTM D 1308
Color Change and Conformity: ASTM D 2244
Creepage: ASTM D 1654
Cyclic Corrosion Test: ASTM D 5894
Flame Spread: ASTM E 84
Flexibility: ASTM D 522
Formability: ASTM D 522
Gloss at 60and 85 degrees: ASTM D 523
Humidity: ASTM D 2247 and ASTM D 714
Oxidation: ASTM D 610
Pencil Hardness: ASTM D 3363
Reverse Impact: ASTM D 2794
Salt Spray: ASTM B 117
Weatherometer: ASTM G 23 and ASTM D 822
ASTM B 117 withstand 2000 hours including scribe requirement. Upon completion of ASTM B 117 test, coating/finish receive rating of 10, no blistering by ASTM D 714 and rating of 7, ASTM D 1654, No. 1.

ASTM G 23/D 2565: accelerated weathering for 2000 hours. No cracking or loss of adhesion.
ASTM D 522: 180 degree bend over 1/8" mandrel; no loss of adhesion or micro-checking.
ASTM D 4214: 2000 hours, no more than No. 8 chalking.
ASTM D 2447: 1000 hours, no signs of blistering, cracking or corrosion
ASTM D 523: 30 plus or minus 5 at 60 degree angle.

2.2.1 Metal Panel System Manufacturer

Provide metal panel system by one of the following manufacturers:

Centria
105 Beaver Grade Road
Moon Township, PA 15108-2944
800-586-1372

McElroy Metals, Inc.
Architectural Products Division
555 Dividend Road
Peachtree City, GA 30269
800-950-6533

2.3 MISCELLANEOUS METAL FRAMING

2.3.1 General

Provide cold formed metallic-coated steel sheet conforming to ASTM A 653/A 653M, AISI/COS/NASPEC, and as specified in 05 40 00 COLD-FORMED METAL FRAMING unless otherwise indicated.

2.3.2 Fasteners and Miscellaneous Metal Framing

Provide compatible type, corrosion resistant, of sufficient size and length to penetrate the supporting element a minimum of one inch with other required properties to fasten miscellaneous metal framing members to substrates in accordance with the roof panel manufacturer's and ASCE/SEI 7-05 requirements.

2.3.2.1 Exposed Fasteners

Fasteners for roof panels must be corrosion resistant coated steel, compatible with the sheet panel or flashing material and of the type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories must be the manufacturer's standard. Provide an integral metal washer, matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick for exposed fasteners.

2.3.2.2 Screws

Provide corrosion resistant screws, coated steel of the type and size recommended by the manufacturer to meet the performance requirements.

2.3.2.3 Attachment Clips

Provide hot-dip galvanized, conforming to ASTM A 653/A 653M, clips. Size, shape, thickness and capacity must meet the thickness and design load criteria specified.

2.3.3 Electrodes for Manual, Shielded Metal Arc Welding

Electrodes for manual, shielded metal arc welding must meet the requirements of AWS D1.1/D1.1M, and be covered, mild-steel electrodes conforming to AWS A5.1/A5.1M.

2.4 ACCESSORIES

Accessories must be compatible with the metal roof panels. Sheet metal flashing, trim, metal closure strips, caps, and similar metal accessories must be not less than the minimum thicknesses specified for roof panels. Provide exposed metal accessories to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips must be closed-cell or solid-cell synthetic rubber or neoprene premolded to match configuration of the panels and not absorb or retain water.

2.4.1 Pre-manufactured Accessories

Pre-manufactured accessories must be manufacturer's standard for intended purpose, comply with applicable specification section, compatible with the metal roof system and approved for use by the metal roof panel manufacturer. Construct curbs to match roof slope.

2.4.2 Metal Closure Strips (Primary Closure)

Provide factory fabricated steel closure strips of the same gauge, color, finish and profile as the specified roof panel.

2.4.3 Rubber Closure Strips (Secondary Closure)

Provide closed-cell, expanded cellular rubber closure strips conforming to ASTM D 1056 and ASTM D 1667, extruded or molded to the configuration of the specified roof panel profile and in lengths supplied by roof panel manufacturer.

2.5 JOINT SEALANTS

2.5.1 Sealants

Sealants are to be an approved gun type for use in hand or air pressure caulking guns at temperatures above 40 degrees F (or frost-free application at temperatures above 10 degrees F) with a minimum solid content of 85 percent of the total volume. Sealant must dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather tight joint. No migratory staining, in conformance with to ASTM C 792, is permitted on painted or unpainted metal, stone, glass, vinyl or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the roof panel manufacturer.

2.5.1.1 Shop Applied Sealants

Sealant for shop-applied caulking must be an approved gun grade, non-sag one-component polysulfide or silicone conforming to ASTM C 792 and ASTM C 920, Type II, with a curing time which ensures the sealants plasticity at the time of field erection. Color to match panel color.

2.5.1.2 Field Applied Sealants

Sealants for field-applied caulking must be an approved gun grade, non-sag on-component polysulfide or two component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to ASTM C 920, Type II. Color to match panel color.

2.5.1.3 Tape Sealants

Provide pressure sensitive, 100 percent solid tape sealant with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof panel manufacturer.

2.5.2 Sheet Metal Flashing and Trim

2.5.2.1 Fabrication, General

Custom fabricate sheet metal flashing and trim to comply with recommendations within the SMACNA 1793 that apply to design, dimensions, metal type, and other characteristics of design indicated. Shop fabricate items to the greatest extent possible. Obtain and verify field measurements for accurate fit prior to shop fabrication. Fabricate flashing and trim without excessive oil canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

2.6 INSULATION

Insulation, facer material and attachment must be compatible with metal roof system specified, as approved by the roof panel manufacturer.

2.6.1 Fire Rated Roof Panel Assembly

Provide materials for fire-rated roof panel construction as follows:

Impaling clips, accessories, and fasteners must be UL listed 40 U18.24 UL Bld Mat Dir galvanized steel sheet or impaling bolts welded to each wall unit joint and spaced not more than 48 inches on center.

Provide bar subgirts 1-1/2- by 1/8 inch galvanized steel with slotted holes for welding to end of impaling clip spikes.

Provide galvanized steel structural angles and flashing angles, gage or thickness as indicated, or material as specified. Flashing angles must be not less than No. 18 U.S. standard gage.

Provide hot-dip galvanized steel metal facing conforming to ASTM A 653/A 653M, Grade A. Coating must conform to, ASTM A 653/A 653M and ASTM A 924/A 924M.

Metal facing must be as indicated and fabricated of enamel-coated hot-dip galvanized steel conforming to ASTM A 653/A 653M, Grade A. Coating must conform to ASTM A 653/A 653M and ASTM A 924/A 924M. Provide Class A fire

hazard classification finish. Flame spread, fuel contributed, or smoke developed cannot exceed a value of 25.

Submit fire rating test report to contracting officer for review and approval. Secure written approval prior to commencement of installation.

2.7 UNDERLAYMENTS

2.7.1 Self-Adhering Polyethylene Film Ice and Water Shield Underlayment

Provide self-adhering polyethylene film membrane ice and water shield underlayment material in compliance with ASTM D 1970, suitable for use as underlayment for metal roofing. Provide 30 mil membrane with tensile strength of 250 PSI, elongation factor of 250%, adhesion to plywood of 3 lb/in width. Permeance (max) of 0.05 perms max and installed material weight of 0.22 lb/sf.

2.8 GASKETS AND SEALING/INSULATING COMPOUNDS

Gaskets and sealing/insulating compounds must be nonabsorptive and suitable for insulating contact points of incompatible materials. Sealing/insulating compounds must be non-running after drying.

2.9 FINISH REPAIR MATERIAL

Repair paint for color finish enameled roofing must be compatible paint of the same formula and color as the specified finish furnished by the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work. Ensure surfaces are suitable, dry and free of defects and projections which might affect the installation.

Examine primary and secondary roof framing to verify that rafters, purlins, angels, channels, and other structural support members for panels and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer, UL, ASTM, and ASCE/SEI-7-05 requirements.

Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking; and that installation is within flatness tolerances required by metal roof panel manufacturer.

Examine rough-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of panels prior to installation.

Submit a written report to the Contracting Officer, endorsed by the installer, listing conditions detrimental to the performance of the work. Proceed with installation only after defects have been corrected.

3.2 INSTALLATION

Installation must meet specified requirements and be in accordance with the manufacturer's installation instructions and approved shop drawings. Do not install damaged materials. Dissimilar materials which are not compatible when contacting each other must be insulated by means of gaskets or sealing/insulating compounds. Keep all exposed surfaces and edges clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Remove stained, discolored, or damaged materials from the site.

3.2.1 Preparation

Clean all substrate substances which may be harmful to insulation, and roof panels including removing projections capable of interfering with insulation, and roof panel attachment.

Install sub-purlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

3.2.2 Underlayment

Install underlayment according to roof panel manufacturer's written recommendations and recommendation in NRCA "The NRCA Roofing and Waterproofing Manual".

3.2.2.1 Self-Adhering Sheet Underlayment

Install self-adhering sheet underlayment; wrinkle free on roof deck. Comply with low-temperature installation restrictions of manufacturer where applicable. Install full coverage over roof deck, lapped in a shingle fashion to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days. Repair any damage or unadhered edges prior to finished roof installation.

3.3 INSULATION INSTALLATION

Install insulation concurrently with metal roof panel installation, in thickness indicated on drawings, to cover entire roof, according to manufacturer's written instructions.

3.4 PROTECTION OF APPLIED MATERIALS

Do not permit storing, walking, wheeling, and trucking directly on applied roofing/insulation materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing/insulation materials, and to distribute weight to conform to indicated live load limits of roof construction.

3.5 FASTENER INSTALLATION

Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions.

3.5.1 Welding

Procedures for manual, shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work must be in accordance with AWS D1.1/D1.1M.

3.6 FLASHING, TRIM, AND CLOSURE INSTALLATION

3.6.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently water tight and weather resistant. Work is to be accomplished to form weather tight construction without waves, warps, buckles, fastening stresses or distortion, and to allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accomplish the work must conform to the manufacturers written instructions.

3.6.2 Metal Flashing

Install exposed metal flashing at building corners, rakes, eaves, junctions between metal siding and roofing, valleys and changes off slope or direction in metal roofing, building expansion joints and gutters.

Exposed metal flashing must be the same material, color, and finish as the specified metal roofing panels. Furnish flashing in minimum 8 foot lengths. Exposed flashing must have 1 inch locked and blind soldered end joints, with expansion joints at intervals of no greater than 16 feet.

Fasten flashing at not more than 8 inches on center for roofs, except where flashing is held in place by the same screws used to secure panels. Exposed flashing and flashing subject to rain penetration must be bedded in specified joint sealant. Flashing which is contact with dissimilar metals must be isolated by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge. Provide sheet metal closures at flashing terminations.

3.7 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels or other components of the Work securely in place, with provisions for thermal and structural movement in accordance with NRCA ASMMRM.

Steel Roof Panels: Use stainless steel fasteners for exterior surfaces and galvanized fasteners for unexposed surfaces.

Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions. Provide all blocking and nailers as required.

Metal Protection: Where dissimilar metals contact each other or possibly corrosive substrates, protect against galvanic action by permanent separation as recommended by the metal roof panel manufacturer.

Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and required for weatherproof performance of metal roof panel system. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

3.7.1 Handling and Erection

Erect roofing system in accordance with the approved erection drawings, printed instructions and safety precautions of the manufacturer.

Do not subject panels to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective panels. Damaged panels must be replaced and removed from the site at the contractor's expense. Erect panels true, plumb, and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with indicated rake, eave, and curb overhang. Allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Do not permit storage, walking, wheeling or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of the roof construction.

Roof panels must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than 8 inches; side laps of standard exterior corrugated panels must not be less than 2-1/2 corrugations.

Field cutting of metal roof panels by torch is not permitted. Field cut only as recommended by manufacturer's written instructions.

3.7.2 Closure Strips

Install metal double closure strips at open ends of metal ridge rolls; open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof, unless open ends are concealed with formed eave flashing; rake of metal roof unless open end has a formed flashing member; and in other required areas.

Install closure strips at intersection of the wall with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.7.3 Workmanship

Make lines, arises, and angles sharp and true. Free exposed surfaces from any visible wave, warp, buckle and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and as necessary to make the work watertight.

3.8 ACCEPTANCE PROVISIONS

3.8.1 Erection Tolerances

Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Horizontal lines must not vary more than 1/8 inch in 40 feet.

3.8.2 Leakage Tests

Finished application of metal roofing is to be subject to inspection and test for leakage by the Contracting Officer or his designated representative, and Architect/Engineer. Inspection and tests will be conducted without cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and removal/replacement of defective materials.

3.8.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials and as recommended by the metal roof panel manufacturer. Finished repaired surfaces must be uniform and free from variations of color and surface texture. Repaired metal surfaces that are not acceptable to the project requirements are to be immediately removed and replaced with new material.

3.8.4 Paint Finished Metal Roofing

Paint finished metal roofing will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period. Panels that indicate color changes, fading, or surface degradation, determined by visual examination, must be removed and replaced with new panels at no expense to the Government. New panels will be subject to the specified tests for an additional year from the date of their installation.

3.9 CLEAN UP AND DISPOSAL

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating. Touch up scratches in panel finish with manufacturer supplied touch-up paint system to match panel finish.

Collect all scrap/waste materials and place in containers. Promptly dispose of demolished and scrap materials. Do not allow scrap/waste materials to

accumulate on-site; transport immediately from the government property and legally dispose of them.

3.10 FIELD QUALITY CONTROL

3.10.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three times during the installation for purposes of reviewing materials installation practices and adequacy of work in place. Make inspections during the first 20 squares of roof panel installation, at mid-point of the installation, and at substantial completion, at a minimum. After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

Submit two signed copies of the manufacturer's field inspection reports to the Contracting Officer within one week of substantial completion.

3.11 INFORMATION CARD

For each type of roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm (0.032) inch thick aluminum card for exterior display. Format as directed in paragraph titled "Form One".

Make card 8 1/2 by 11 inches minimum. Information card must identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, roof panel manufacturer and product name, type underlayment(s), date of completion; installing contractor identification and contact information; manufacturer warranty expiration, warranty reference number, and contact information. Install card at location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

3.11.1 Form One

FORM 1 - PREFORMED STEEL PANEL ROOFING SYSTEM AND COMPONENTS

1. Contract Number:

2. Building Number & Location:

3. NAVFAC Specification Number:

4. Deck/Substrate Type:

5. Slopes of Deck/Roof Structure:

6. Insulation Type & Thickness:

7. Insulation Manufacturer:

8. Vapor Retarder: ( )Yes ( )No

9. Vapor Retarder Type:

10. Preformed Steel Standing Seam Roofing Description:

a. Manufacturer (Name, Address, & Phone No.):
b. Product Name: c. Width: d. Gage:
e. Base Metal: f. Method of Attachment:

11. Repair of Color Coating:

a. Coating Manufacturer (Name, Address & Phone No.):
b. Product Name:
c. Surface Preparation:
d. Recoating Formula:
e. Application Method:

12. Statement of Compliance or Exception:_____
_____
_____

13. Date Roof Completed:

14. Warranty Period: From_____ To_____

15. Roofing Contractor (Name & Address):

16. Prime Contractor (Name & Address):

Contractor's Signature_____ Date:

Roofing Manufacturer Inspector's Signature _____ Date:
Text

-- End of Section --

SECTION 07 42 13

METAL WALL PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501.1	(2005) Methods of Test for Exterior Walls

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002) Cold-Formed Steel Design Manual Set
AISI/COS/NASPEC	(2001, Supplement 2004) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7-05	(2006) Minimum Design Loads for Buildings and Other Structures, Including Supplement No. 1

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M	(2007a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel
ASTM A 606	(2004) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 653/A 653M	(2007) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 755/A 755M	(2003) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1308	(2002; R 2007) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1667	(2005) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 2244	(2007) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 3363	(2005) Film Hardness by Pencil Test
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	(2005) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Standard Test Method for Specular Gloss
ASTM D 5894	(2005) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

ASTM D 610	(2007) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002e1) Evaluating Degree of Blistering of Paints
ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 968	(2005e1) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM	(2002) Metal Building Systems Manual

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2006) Architectural Sheet Metal Manual, Sixth Edition, Second Printing

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 12	(1982; E 2000) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-28578	(Rev B; CANC Notice 1) Paint, Water-Borne, Acrylic or Modified Acrylic, Semi-Gloss, for Metal Surfaces

UNDERWRITERS LABORATORIES (UL)

UL 580	(2006) Tests for Uplift Resistance of Roof Assemblies
UL Bld Mat Dir	(2007) Building Materials Directory

1.2 DEFINITIONS

Metal Wall Panel: Metal wall panels, attachment system components and accessories necessary for a complete weather-tight wall system.

1.3 DESCRIPTION OF WALL PANEL SYSTEM

Factory color finished, metal wall panel system with concealed fastening attachment. Panel profiles must be as shown on drawings.

1.3.1 Metal Wall Panel General Performance

Comply with performance requirements, conforming to AISI/COS/NASPEC, without failure due to defective manufacture, fabrication, installation, or other defects in construction. Wall panels and accessory components must conform to the following standards:

ASTM A 1008/A 1008M
ASTM A 123/A 123M
ASTM A 36/A 36M
ASTM A 653/A 653M
ASTM A 606
ASTM D 522 for applied coatings
UL Bld Mat Dir

1.3.2 Structural Performance

Maximum calculated fiber stress must not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads is limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal siding. Contractor must provide design for members and connections not shown on the drawings. Siding panels and accessories must be the products of the same manufacturer.

Provide metal wall panel assemblies complying with the load and stress requirements in accordance with ASTM E 1592. Wind Load force due to wind action governs the design for panels.

Wall systems and attachments are to resist the wind loads as determined by UL 580 and ASCE/SEI 7-05 in the geographic area where the construction will take place, in pounds per square foot. Submit five copies of wind load tests and seismic tests to the Contracting Officer.

1.3.3 Air Infiltration

Air leakage must conform to the limits through the wall assembly area when tested according to ASTM E 283.

1.3.4 Water Penetration Under Static Pressure

No water penetration when tested according to ASTM E 331.

1.3.5 Water Penetration Under Dynamic Pressure

No evidence of water leakage when tested according to AAMA 501.1.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submit Documentation for the following items:

Qualification of Manufacturer;
Qualification of Installer;
Sample Warranty;

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Submit Manufacturer's catalog data for the following items:

Factory Color Finish
Closure Materials
Pressure Sensitive Tape
Sealants and Caulking
Accessories

SD-04 Samples

Submit as required each of the following samples:

Wall Panels, 12 inches long by actual panel width;
Fasteners;
Metal Closure Strips, 10 inches long of each type;

Submit manufacturer's color charts and chips, approximately 4 by 4 inches, showing full range of colors, textures and patterns available for wall panels with factory applied finishes.

SD-05 Design Data

As applicable, submit the following wind load design analysis; data, to include, but not limited to:

wind speed
exposure category,co-efficient,importance factor
type of facility
negative pressures for each zone
methods and requirements of attachment

SD-06 Test Reports

Submit test reports for the following in accordance with the referenced articles in this section.

Leakage Tests;
Wind Load Tests;
Coatings and Base Metal Tests;
Chalking Tests;

SD-07 Certificates

Submit certificates for the following items showing conformance with referenced standards contained in this section:

Fasteners;

SD-08 Manufacturer's Instructions

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications.

Installation of Wall panels;

SD-09 Manufacturer's Field Reports

Submit 2 copies of the Manufacturer's Field Reports;

SD-11 Closeout Submittals

Warranty;
Maintenance Instructions;

1.5 QUALITY ASSURANCE

1.5.1 Pre-Installation Conference

Upon notification of submittal receipt and approval by the Contracting Officer; and prior to the commencement of the work, the Contractor must attend a pre-installation conference to review the following:

a. Drawings and Specifications.

b. Qualification of Installer.

d. Sample Warranty

e. Sample wall panels, 12 inches long by actual panel width

f. Sample metal closure strips, 10 inches long of each type

g. Color charts and chips

h. Coatings and base metal tests, chalking tests

i. Construction schedule, availability of materials, Installer's personnel, equipment and facilities required to progress with the work without delay.

j. Methods and procedures related to installation of wall panels, including manufacturer's written instructions. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

k. Support conditions for compliance with requirements, including alignment between and attachment to structural members.

l. Flashing, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.

m. Governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

n. Temporary protection requirements for metal wall panel assembly during and after installation.

o. Wall panel observation and repair procedures after metal wall panel installation. Provide detailed written instructions including copies of Material Safety Data Sheets for maintenance and repair materials, and manufacturer's maintenance instructions.

1.5.1.1 Installation Drawings

Installation shop drawings for wall panels, flashing, accessories, and anchorage systems must indicate completely dimensioned structural frame and erection layouts, openings in the wall, special framing details, and construction details at corners, building intersections and flashing, location and type of mastic and metal filler strips.

1.5.1.2 Wind Load Design Analysis

Wind design analysis must include wall plan delineating dimensions and attachment patterns for each zone. Wind design analysis must be prepared and sealed by Licensed Project Engineer in the geographic area where the construction will take place.

1.5.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and installations in the geographical area where construction will take place.

1.5.3 Qualification of Manufacturer

Certify that metal wall panel system manufacturer has a minimum of five (5) years experience in manufacturing metal wall system and accessory products.

Manufacturer must also provide engineering services by an authorized engineer; currently licensed in the geographical area where construction will take place, having a minimum of four (4) years experience as an engineer knowledgeable in wind load design analysis, protocols and

procedures per MBMA MBSM, "Metal Building Systems Manual"; ASCE/SEI 7-05, and ASTM E 1592.

Provide certified engineering calculations, using the products submitted, for Wind load requirements in accordance with ASCE/SEI 7-05.

1.5.3.1 Manufacturer's Certificates

Also provide the following certifications from the manufacturer:

Coil Stock
Fasteners

Submit certification from coil stock manufacturer or supplier that the machinery used will form the provided coil stock without warping, waviness, or rippling that is not a part of the panel profile, and without damage, abrasion or marring of the finish coating.

Provide evidence that products used within this specification are manufactured in the United States.

1.5.4 Certified Qualification of Installation Contractor

The installation contractor must be approved and certified by the metal wall panel manufacturer prior to beginning the installation of the metal wall panel system. Subcontracting by Certified Contractor for the metal wall panel work is not permitted.

1.5.5 Single Source

Obtain each type of metal wall panels, clips, closure materials and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

1.6 DELIVERY, HANDLING, AND STORAGE

Deliver and protect package components, sheets, metal wall panels, and other manufactured items to prevent damage or deformation during transportation and handling.

Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack and store metal wall panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

Retain strippable protective covering on metal wall panel until actual installation.

1.7 PROJECT CONDITIONS

1.7.1 Field Measurements

Verify locations of wall framing and opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1.7.2 Weather Limitations

Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into wall system or building.

1.8 WARRANTY

Warranty must conform to the Sample Warranty as reviewed and approved by the Contracting Officer at the Pre-Installation Conference.

PART 2 PRODUCTS

2.1 METAL PANELS

2.1.1 Concealed Fastener Panels

Panels for walls, soffits and fascias shall be steel and shall have a factory-applied color finish. Wall panels shall have interlocking ribs for securing adjacent sheets. Panels shall be fastened to framework using concealed fasteners. Length of panels shall be sufficient to cover the entire height of any unbroken wall surface except where reveals are indicated. Panels shall be formed without warping, waviness, or ripples that are not a part of the panel profile and shall be free of damage to the finish coating system.

All exterior flashing and trim shall be fabricated in the same material, gage, finish and color as the exterior profile.

Zinc-coated steel conforming to ASTM A 653/A 653M, Structural Grade 40 and minimum G90 galvanized smooth metallic coating. Prepainted steel sheet shall also comply with ASTM A 755/A 755M. Wall and soffit panel material shall be minimum 22 ga. thick prior to coating application, and as required to meet wind load requirements. Panels shall be within 95 percent of the nominal thickness. Wall and soffit panels shall be smooth, 1 1/2" in depth and provide 12" of coverage width with tight joints between panels. Exterior surface shall have a 12 inch flush plane with a single stiffening bead located in the center of the 12 inch width. Prior to shipment, panels shall be treated with a passivating chemical and oiled to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.1.2 Exposed Fastener Panels

Panels for walls shall be steel and shall have a factory-applied color finish. Provide panel profiles indicated. Panels shall be fastened to framework using exposed fasteners. Length of panels shall be sufficient to cover the entire height of any unbroken wall surface except where reveals are indicated. Panels shall be formed without warping, waviness, or ripples that are not a part of the panel profile and shall be free of damage to the finish coating system.

All exterior trim shall be fabricated in the same material, gage, finish and color as the exterior profile.

Zinc-coated steel conforming to ASTM A 653/A 653M, Structural Grade 37 and minimum G90 galvanized smooth metallic coating. Prepainted steel sheet shall also comply with ASTM A 755/A 755M. Wall panel material shall be minimum 22 ga. thick prior to coating application, and as required to meet wind load requirements. Panels shall be within 95 percent of the nominal thickness. Wall panels shall be smooth and provided in two profiles:

a. Deep Ribbed Metal Panels shall have 36 inch of coverage width and 1 1/2 inch deep symmetrical ribs spaced at 7.2 inches with angular transitions, and with factory mitered edges where corners will be formed by adjacent panels.

b. Corrugated Metal Panels shall have 36 inch minimum coverage width and 1/2 inch deep symmetrical corrugations spaced at 2.67 inches.

Prior to shipment, panels shall be treated with a passivating chemical and oiled to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.1.3 Factory Insulated Wall Panels

Insulated wall panels shall be factory-fabricated flat panel units with integral reveals and insulating core between metal face sheets, securely fastened together and uniformly separated with rigid spacers; facing of embossed 22 gage steel, and liner panel of embossed 22 gage steel with primer and acrylic finish. Provide horizontal panels with joint configuration indicated. Panels shall be 2 inches thick and R14 or greater. Panels shall have a factory-applied color finish. The assembly shall have a flame spread rating not higher than 75, and smoke developed rating not higher than 450 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and not become a source of food and shelter for insects. Provide factory formed corners with lengths as indicated. Provide extrusions fabricated of 6063-T5 aluminum with exposed surfaces painted to match wall panels.

2.2 FABRICATION

Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. Fabricate metal wall panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

2.2.1 Sheet Metal Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 that apply to the design, dimensions, metal, and other characteristics of item indicated:

a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

b. End Seams: fabricate nonmoving end seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

c. Sealed Joints: form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA 1793.

d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA 1793 or by metal wall panel manufacturer for application, but not less than thickness of metal being secured.

2.3 PANEL MATERIALS

2.3.1 Steel Sheet

Roll-form steel wall panels to the specified profile, with gauge and depth as indicated. Material must be plumb and true, and within the tolerances listed:

a. Galvanized Steel Sheet conforming to ASTM A 653/A 653M and AISI SG03-3.

b. Individual panels must be continuous length to cover the entire length of any unbroken wall area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.

c. Provide panels with thermal expansion and contraction consistent with the type of system specified.

i. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated wall area.

ii. Embossed Surface Texture.

2.3.2 Factory Color Finish

Comply with NAAMM AMP 500 for recommendations for applying and designating finishes. Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

All panels are to receive a factory-applied Kynar 500/Hylar 5000 finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

2.3.2.1 Metal Preparation

Carefully prepare all metal surface for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.

2.3.2.2 Prime Coating

Apply a base coat of epoxy paint, specifically formulated to interact with the top-coat, to the prepared surfaces by roll coating to a dry film thickness of 0.20 mils. Prime coat must be oven cured prior to application of finish coat.

2.3.2.3 Exterior Finish Coating

Roll coat the finish coating over the primer by roll coating to dry film thickness of 0.80 for a total dry film thickness of 1.00. Oven-cure finish coat.

2.3.2.4 Interior Finish Coating

Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.20 + a backer coat of 0.30 for a total dry film thickness of 0.50. Oven-cured the wash coat.

2.3.2.5 Color

Provide exterior finish color as as specified.

2.3.2.6 Physical Properties

Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General: SSPC Paint 12, MIL-P-28578, ASTM D 5894, and ASTM D 4587.
Abrasion: ASTM D 968
Adhesion: ASTM D 3359
Chalking: ASTM D 4214
Chemical Pollution: ASTM D 1308
Color Change and Conformity: ASTM D 2244
Creepage: ASTM D 1654
Cyclic Corrosion Test: ASTM D 5894
Flame Spread: ASTM E 84
Flexibility: ASTM D 522
Formability: ASTM D 522
Gloss at 60 and 85 degrees: ASTM D 523
Humidity: ASTM D 2247 and ASTM D 714
Oxidation: ASTM D 610
Pencil Hardness: ASTM D 3363
Reverse Impact: ASTM D 2794
Salt Spray: ASTM B 117
Weatherometer: ASTM G 23 and ASTM D 822

2.4 MISCELLANEOUS METAL FRAMING

Cold-formed metallic-coated steel sheet conforming to ASTM A 653/A 653M and specified in Section 05 40 00 COLD-FORMED METAL FRAMING unless other wise indicated.

2.4.1 Fasteners for Miscellaneous Metal Framing

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to supporting members and substrates in accordance with the wall panel manufacturer's and ASCE/SEI 7-05 requirements.

2.5 FASTENERS

2.5.1 General

2.5.1.1 Hidden Fasteners

Provide corrosion resistant fasteners recommended by the manufacturer to meet the performance requirements and design loads.

2.5.1.2 Screws

Screws to be corrosion resistant coated steel, and/or 300 - series or 305 - series stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

2.5.1.3 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

2.5.1.4 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A 653/A 653M, Z275 G 90 or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

2.6 ACCESSORIES

2.6.1 General

All accessories must be compatible with the metal wall panels. Sheet metal flashing, trim, metal closure strips, caps and similar metal accessories must not be less than the minimum thickness specified for the wall panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips must be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

2.6.2 Rubber Closure Strips

Provide closed-cell, expanded cellular rubber conforming to ASTM D 1056 and ASTM D 1667; extruded or molded to the configuration of the specified wall panel and in lengths supplied by the wall panel manufacturer.

2.6.3 Metal Closure Strips

Provide factory fabricated steel closure strips to be the same gauge, color, finish and profile of the specified wall panel.

2.6.4 Joint Sealants

2.6.4.1 Sealants and Caulking

Provide approved gun type sealants for use in hand- or air-pressure calking guns at temperatures above 40 degrees F 4 degrees C (or frost-free application at temperatures above 10 degrees F minus 12 degrees C) with minimum solid content of 85 percent of the total volume. Sealants must dry with a tough, durable surface skin which permit remaining soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints receiving sealants with a compatible one-component or two-component primer as recommended by the wall panel manufacturer.

2.6.4.2 Shop-Applied

Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to ASTM C 920, Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

2.6.4.3 Field-Applied

Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to ASTM C 920, Type II. Color to match panel colors.

2.6.4.4 Pressure Sensitive Tape

Provide pressure sensitive tape sealant, 100% solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the wall panel manufacturer.

2.7 SHEET METAL FLASHING AND TRIM

2.7.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in SMACNA 1793 that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

2.8 REPAIR OF FINISH PROTECTION

Repair paint for color finish enameled wall panel must be compatible paint of the same formula and color as the specified finish furnished by the wall

panel manufacturer. Provide 2 quarts of repair paint matching the specified wall panels.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.

Examine primary and secondary wall framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer, UL, ASTM, ASCE/SEI 7-05 and as required for the geographical area where construction will take place.

Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

Submit to the Contracting Officer a written report, endorsed by Installer, listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment. Miscellaneous framing installation, including sub-purlins, girts, angles, furring, and other miscellaneous wall panel support members and anchorage must be according to metal wall panel manufacturer's written instructions.

3.3 WALL PANEL INSTALLATION

Provide full length metal wall panels, from sill to eave as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement in accordance with MBMA MBSM.

Erect wall panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Bent, chipped, or defective sheets shall not be applied.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated eave, and sill.

Work is to allow for thermal movement of the wall panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal wall panels by torch is not permitted.

3.3.1 Steel Wall Panels

Use stainless-steel fasteners for exterior surfaces and galvanized steel fasteners for interior surfaces.

3.3.2 Anchor Clips

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.3.3 Metal Protection

Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.3.4 Joint Sealers

Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

3.4 FASTENER INSTALLATION

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.5 FLASHING, TRIM AND CLOSURE INSTALLATION

3.5.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams to form permanently watertight and weather resistant.

Install sheet metal work is to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

3.5.2 Metal Flashing

Install exposed metal flashing at building corners, sills and eaves, junctions between metal siding and walling. Exposed metal flashing must be the same material, color, and finish as the specified metal wall panel.

Fasten flashing at a minimum of 8 inches on center, except where flashing is held in place by the same screws that secure covering sheets.

Flashing is to be furnished in at least 8 foot lengths. Exposed flashing is to have 1 inch locked and blind-soldered end joints, and expansion joints at intervals of not more than 16 feet.

Exposed flashing and flashing subject to rain penetration to be bedded in the specified joint sealant.

Isolate flashing which is in contact with dissimilar metals by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge.

3.5.3 Closures

Install metal closure strips at open ends of corrugated or ribbed pattern walls, and at intersection of wall and wall unless open ends are concealed with formed eave flashing; and in other required areas.

Install mastic closure strips at intersection of the wall with metal walling; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.6 WORKMANSHIP

Make lines, arises, and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side.Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

3.7 ACCEPTANCE PROVISIONS

3.7.1 Erection Tolerances

Erect metal wall panels straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions.

3.7.2 Leakage Tests

Finished application of metal wall panels are to be subject to inspection and test for leakage by request of the Contracting Officer, Architect/Engineer. Conduct inspection and tests at no cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and the removal and replacement of defective materials.

3.7.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials. Finished repaired surfaces must be uniform and free from variations of color and surface texture.

Repaired metal surfaces that are not acceptable to the project requirements and/or Contracting Officer are to be immediately removed and replaced with new material.

3.7.4 Paint-Finish Metal Siding

Paint-finish metal siding will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period.

Panels that indicate color changes, fading, or surface degradation, determined by visual examination, must be removed and replaced with new panels at no expense to the Government.

New panels will be subject to the specified tests for an additional year from the date of their installation.

3.8 FIELD QUALITY CONTROL

3.8.1 Construction Monitoring

Make visual inspections as necessary to ensure compliance with specified requirements. Additionally, verify the following:

a. Materials comply with the specified requirements.

b. All materials are properly stored, handled and protected from damage. Damaged materials are removed from the site.

c. Framing and substrates are in acceptable condition, in compliance with specification, prior to application of wall panels.

d. Panels are installed without buckles, ripples, or waves and in uniform alignment and modulus.

e. Side laps are formed, sealed, fastened or seam locked as required.

f. The proper number, type, and spacing of attachment clips and fasteners are installed.

g. Installer adheres to specified and detailed application parameters.

h. Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Provide five bound copies of Manufacturer's Field Reports to the Contracting Officer two weeks prior to project close-out.

3.9 CLEAN-UP AND DISPOSAL

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area continuously as work progresses. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, rust stains, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

Collect and place scrap/waste materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site; transport demolished materials from government property and legally dispose of them.

-- End of Section --

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2170	(2001a) Kinematic Viscosity of Asphalts (Bitumens)
ASTM D 228	1990a (Reapproved 1996) Standard Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles
ASTM D 312	(2000) Asphalt Used in Roofing
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4402	(2002) Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free
ASTM D 5147	(1997) Standard Test Method for Sampling and Testing Modified Bituminous Sheet Material
ASTM D 5849	(1995) Standard Test Method for Evaluating Resistance of Modified, Bituminous Roofing Membranes to Cyclic Joint Displacement
ASTM D 6162	(2000a) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D 6163	(2000e1) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

ASTM D 6164	(2000) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM E 108	(2000) Fire Tests of Roof Coverings

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2003) Approval Guide

UNDERWRITERS LABORATORIES (UL)

UL 790	(2004) Test Methods for Fire Tests of Roof Coverings
UL RMSD	(2004) Roofing Materials and Systems Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00, "Submittal Procedures."

SD-03 Product Data

Modified Bitumen Sheet;

Felts;

Primer;

Asphalt roof cement;

Fasteners;

Roof and Deck Insulation; G

Sample warranty certificate

Asphalt;

SD-07 Certificates

Qualification of manufacturer;

Qualification of applicator;

Warranty Application;

SD-08 Manufacturer's Instructions

Modified bitumen sheet;

Felts;

Primer;

Asphalt roof cement;

Fasteners;

Flashings;

Asphalt;

Cold weather installation

SD-11 Closeout Submittals

Information card;

1.3 QUALITY ASSURANCE

1.3.1 Product Data Requirements

Submit data for the roof insulation and modified Bitumen sheet as required below:

1.3.1.1 Roof Insulation Product Data Requirements

Submit all data required by Section 07220, "Roof and Deck Insulation," together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation provided.

1.3.1.2 Modified Bitumen Sheet Product Data Requirements

Manufactures published catalog data shall include the following information for each sheet type specified. This information shall be presented in the same units of measure stated in this specification and its referenced standards. The test method for determining the following sheet requirements are found in ASTM D 5147, ASTM D 228 for Net Mass (Weight) requirements, and in ASTM D 5849 for cyclic joint displacement.

a. Dimensions and Weight

(1) Thickness
(2) Net Mass (Weight)

b. Physical and Mechanical Properties

(1) Sheet type
(2) Load strain properties
(3) Ultimate elongation (fiberglass reinforcing only)
(4) Tear strength
(5) Low temperature flexibility
(6) Dimensional stability
(7) Compound stability
(8) Granule embedment

c. Performance

(1) Cyclic joint displacement

1.3.2 Manufacturer's Instruction Requirements

Include detailed application instructions and standard drawings altered as required by these specifications for modified bitumen sheet, primer, fasteners, asphalt roof cement, flashings, asphalt, and cold weather installation. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

1.3.3 CERTIFICATE REQUIREMENTS

1.3.3.1 Manufacturers Qualifications Certificates

Certify that the manufacturer of the modified bitumen membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer." Show evidence that products used within this specification are manufactured in the United States. Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

1.3.3.2 Warranty Application Certificate

Provide copy of Application for Roofing Guarantee from roofing contractor and Letter of Intent to Warrant for the roofing system by the Manufacturer.

1.3.4 Closeout Submittal Requirements

Furnish requirements as specified in paragraph entitled "Information Card" in PART 3 of this section.

1.3.5 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer shall have a minimum of 5 years experience in manufacturing modified bitumen roofing products specified herein.

1.3.6 Qualification of Applicator

Roofing system applicator shall be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and shall have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator shall supply the names and locations of 5 projects of similar size and scope that he has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.3.7 Fire Safety

Complete roof covering assembly shall:

a. Have ASTM E 108 Class 1A or UL 790, Class A classification; and

b. Be listed as part of Fire-Classified roof deck construction in UL RMSD, or Class I roof deck construction in FM P7825.

UL approved components of the roof covering assembly shall bear the UL label.

1.3.8 Wind Uplift

Complete roof covering assembly including the roof insulation shall be tested and rated in compliance with FM P7825 and shall be installed to meet an FM 1A-90 classification for the field of the roof with respective increased fastener attachment at the perimeters and corners of the roof.

1.3.9 Preroofing Conference

After approval of submittals and before performing roofing and insulation work, including associated work, the Contractor will hold a preroofing conference to review the following:

a. Drawings and specifications;

b. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, roof insulation, and installation of the roofing in accordance with the roof system warranty, the name of the manufacturer's technical representatives, the frequency of the onsite visits, copies of the roof status reports from the technical representatives to roof manufacturer, and pertinent structural details relating to the roofing system;

c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

d. Safety requirements.

Preroofing conference shall be attended by the designer, the Government, the Contractor and personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, mechanical and electrical work and representative of the roofing materials manufacturer. Before beginning roofing work, confirm in writing the resolution of conflicts among those attending the preroofing conference.

1.3.10 Field Samples and Tests

The Government reserves the right to sample roofing materials at random from the products delivered to the job site and test them to verify the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification or the approved substitution.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Ship modified bitumen sheet rolls stacked vertically on pallets wrapped with shrink wrap or shrink bags. Pallets to be surfaced with a continuous smooth surface to avoid damage to ends of rolls. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container shall bear the specification number, type, and class, as applicable. Labels or bill of lading for roofing asphalt shall indicate asphalt type, FP, FBT, and EVT, that is, the temperature at which the viscosity is either 125 centistokes when tested in accordance with ASTM D 2170 or 75 centipoise when tested in accordance with ASTM D 4402. Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.4.2 Storage

Protect materials against moisture absorption. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, and mortar is finished and dry. Maintain roll materials at temperatures above 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof and yet provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

1.4.3 Handling

Select and operate material handling equipment so as not to damage applied roofing. Prevent damage to edges and ends of roll materials.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Provide manufacturer's printed directions for installation during cold weather conditions.

1.6 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that flashing and counter flashing are installed as the work progresses. No phasing of the roof membrane system installation will be permitted. Same day installation of mechanically fastened bottom insulation board, adhered upper insulation board(s), base ply, base ply cap flashing, top ply and top ply cap flashing is required.

1.7 WARRANTY

Furnish the modified bitumen sheet roofing system manufacturer's "no-dollar-limit" warranty for the roofing system, including insulation, flashing, and

accessories. The warranty shall run directly to the Government. In no event shall the warranty period be less than 10 years from the date of the Government's acceptance of the work, notwithstanding roofing applicator's or manufacturer's unpaid invoices for installation, supplies, or service. The warranty shall state that:

a. When within the warranty period the roofing system becomes nonwatertight, splits, tears, blisters, or separates at the seams or shows any other evidence of excessive weathering, because of defective materials or workmanship, the repair or replacement of defective materials and correction of defective workmanship shall be the responsibility of the manufacturer;

b. When the manufacturer or the manufacturer's approved applicator fail to perform repairs within 72 hours of notification, emergency repairs performed by others will not void the warranty.

PART 2 PRODUCTS

2.1 DESCRIPTION OF ROOFING SYSTEM

2.1.1 Description of Roofing System

Provide roofing system as described below and capable of passing ASTM D 5849. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles at 14° F -10° C or 200 cycles after heat conditioning. Heat conditioning shall be in accordance to ASTM D 5147.

2.1.2 SBS Modified Bitumen Sheet on Non-Nailable Substrate

Substrate: Metal Deck

Components:	Quantity:
Asphalt Primer	3/4 gal/100 sq. ft.
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Base Sheet (MB)	1 ply
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

2.2 MATERIALS

2.2.1 Asphalt

ASTM D 312, Type IV.

2.2.2 Modified Bitumen Sheet, Felts

Provide all field sheets of the roofing membrane with the same type reinforcing material.

Designation	Use	Felt-Type	Impregnant	Coating	Specification

MB	SBS Modified Base Sheet	Fiber-glass or Poly-ester or combined fiberglass polyester	SBS Modified Bitumen	SBS Modified Bitumen	ASTM D 6162, Grade S, and as modified in subparagraph "a" below ASTM D 6163, Grade S, Type II and as modified in subpara. "b" below ASTM D 6164, Grade S, and as modified in subpara. "c" below
RSS	SBS Bitumen Cap Sheet Roofing Fire rated	Fiber-glass or Poly-ester	SBS Modified Bitumen	SBS Bitumen Granules	ASTM D 6162, Grade G,Type II and as modified in subpara. "a" below ASTM D 6163, Grade G, and as modified in subpara. "b" below ASTM D 6164, Grade G, and as modified in subpara. "c" below
FS	Flashing Sheet Fire rated	Fiber glass or fiberglass or combined	SBS Modified Bitumen	Granule Surfacing	ASTM D 6162, Grade S, and as modified in subparagraph "a" below ASTM D 6163, Grade S, Type II and as modified in subpara. "b" below ASTM D 6164, Grade S, and as modified in subpara. "c" below

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a. ASTM D 6162 Modifications (Combined Polyester and Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements

Property	Type II Grade: G and S
Low Temperature Flexibility, Max Before and After Heat Conditioning °F ° (C)	-5(-20)

(2) "7. Dimensions, Mass, and Permissible Values" Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirement.

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using A Combination of Polyester and Glass Fiber Reinforcements

Description	Type II
Thickness, min, mils (mm)	
Grade S	85 (2.2)
Grade G	150 (3.8)
Grade G (Selvage Edge)	95 (2.4)
Net mass unit area, min lbs/100 ft 2, (g/m2)	
Grade S	58 (2831)
Grade G	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

b. ASTM D 6163 Modifications (Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Property	Type II Grade: G and S
Elongation (ultimate) at 5% of maximum load 73.4 +/- 3.6 degrees F (23 +/- 2 degrees C), MD and XMD, min. (%)	
as manufactured:	40
after heat conditioning:	20
Compound stability at 225 degrees F (107 degrees C)	no failures

(2) "7. Dimensions, Mass and Permissible Variations." Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirement.

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Description	Type II
Thickness, min, mils (mm),	
Grade S	85 (2.2)
Grade G	150 (3.8)
Grade G (Selvage Edge)	95 (2.4)
Net mass/unit area, min, lbs/ft 2 (g/m 2)	
Grade S	58 (2831)
Grade G	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

2.2.3 Top Surfacing

Protect modified bitumen roofing system from direct exposure to the weather with the following surfacing.

2.2.3.1 Mineral Roofing Granules

Factory applied, Type II minimum granule embeddment, requiring no further coating.

2.2.4 Primer

ASTM D 41.

2.2.5 Asphalt Roof Cement

ASTM D 4586, Type II for vertical surfaces, Type I for horizontal surfaces.

2.2.6 Fasteners

Provide noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM AS 4470. For felts, provide fasteners driven through metal discs, or one piece composite fasteners with heads not less than one inch in diameter or one inch square with rounded or 45 degree tapered corners.

2.2.6.1 Concrete Walls and Vertical Surfaces

Provide hardened steel nails with flat heads, diamond shaped points, and mechanically deformed shanks not less than one inch long for securing felts, modified bitumen sheets, and metal Items to concrete walls and vertical surfaces. Use power-driven fasteners only when approved in writing.

2.2.7 Metal Discs (Tin Caps)

Flat noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM AS 4470; not less than 3 inches in diameter, when using screw type fasteners. Discs shall be formed to prevent dishing or cupping.

2.2.8 Roof Insulation Below Modified Bitumen Membrane System

Insulation shall be compatible with the membrane as recommended in modified bitumen manufacturer's printed instructions and as specified in Section 07 22 00, "Roof and Deck Insulation".

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Ensure that the following conditions exist prior to application of the roofing materials:

a. Drains, curbs, cants, perimeter walls, roof penetrating components, and equipment supports are in place.

b. Surfaces are rigid, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.

c. The plane of the substrate does not vary more than 1/4 inch within an area 10 by 10 feet when checked with a 10 foot straight edge placed anywhere on the substrate.

d. Substrate is sloped as indicated to provide positive drainage.

e. Walls and vertical surfaces are constructed to receive counter flashing, and will permit nailing of the base flashing materials.

f. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of felts, edging strips, gravel stops, and roof fixtures. Surface-applied nailers are the same thickness as the roof insulation.

g. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than nominal 4 inches. Cants are constructed of treated wood or wood fiberboard roof insulation.

h. Venting is provided in accordance with the following:

(1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.

i. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. Insulation is being roofed over on the same day the insulation is installed.

j. Cast-in-place substrates have been allowed to cure and the surface dryness requirements specified under paragraph entitled "Field Quality Control" have been met.

3.2 PREPARATION

3.2.1 Protection of Property

3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings not less than six inches, secure against wind, and vent to prevent collection of

moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

3.2.1.2 Flame-Heated Equipment

Do not place flame-heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame-heated equipment and on the roof.

3.2.1.3 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

3.2.2 Priming of Surfaces

Prime surfaces at the rate of 0.75 gallon per 100 sq. ft. or as recommended by modified bitumen sheet manufacturer's printed instructions and allow to dry.

3.2.2.1 Priming of Metal Surfaces

Prime flanges of metal edging strips, prior to stripping into roofing system in accordance with modified bitumen manufacturer's printed instructions and allow to dry.

3.2.3 Heating of Asphalt

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Kettles shall have visible thermometer and thermostatic controls set to the temperature limits specified herein. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus 2 degrees F, to check temperatures of the asphalt frequently. When temperatures exceed maximums specified, remove asphalt from the site. Do no permit cutting back, adulterating, or fluxing of asphalt.

3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by manufacturer's printed application instructions and approved by the Contracting Officer. Keep roofing materials dry before and during application. Do not permit phased construction.Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. Modified Bitumen Base Sheet shall not remain exposed prior to application of the Modified Bitumen Cap Sheet. A hand-held thermometer in required on the roof at all times during roofing installation to check EVT of asphalt.

3.3.1 Base Sheet

Apply base sheets in shingle fashion in hot mopping of asphalt. On nailable substrates, mechanically fasten base sheet in conformance with FM requirements and membrane manufacturer's printed instructions. Where applicable, base sheet may be mechanically fastened in conjunction with

insulation to the substrate, in accordance with membrane manufacturers printed instructions. Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 2 inches unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 6 inches and staggered a minimum of 36 inches. Apply sheets at right angles to the roof slope so that the direction of water flow is over and not against the laps. Extend sheets approximately 2 inches above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim felt to a neat fit around vent pipes, roof drains, and other projections through the roof.Application shall be free of ridges, wrinkles, and buckles or other voids.

3.3.2 Hot-Mopping of Base Sheets

Provide hot asphalt for embedding of base sheets, including modified bitumen base sheet, to the substrate.Apply base sheets immediately following application of hot asphalt. Do not work ahead with asphalt.Asphalt shall be completely fluid, with mop temperatures within the specified EVT range, at the instant base sheets come into contact with asphalt. Application of bitumen between plies shall be such as to provide full, continuous, uniform coverage and complete penetration of asphalt into the sheet above and below. Embed sheets in asphalt. As sheets are being rolled into hot asphalt, immediately and thoroughly squeegee, roll, or broom down to eliminate trapped air and to provide tight, smooth laminations without wrinkles, buckles, kinks, and fish mouths. Completed system shall be free of air pockets, blisters and other voids.

3.3.2.1 Temperature Limitations for Asphalt

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its FBT. Do not heat asphalt between 500 and 525 degrees F for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed base sheets when temperature of asphalt is within plus or minus 25 degrees F of the equiviscous temperature (EVT). Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP, FBT, and EVT of the asphalt used.

3.3.3 Modified Bitumen Sheets

Sheets shall be watertight and visually free of pinholes, particles of foreign matter, undispersed raw material, or other manufacturing defects that might affect serviceability. Edges of seams shall be straight and flat so that they may be seamed to one another without forming fish mouths, wrinkles or other voids.

3.3.3.1 SBS Modified Bitumen Sheets

Solid mop top surface of base sheet with hot asphalt at the rate of 25 pounds per 100 sq. ft. and embed one layer of roofing membrane into hot asphalt. Roll modified bitumen roofing membrane into place with a flow of hot asphalt out of side and end laps. Side laps shall be 4 inches and end laps shall be 6 inches or as recommended by the manufacturer. Stagger end laps a minimum of 36 inches. Back mop end laps. Apply roofing in a

continuous application. Start installation at the low point of the roof and progress to the high point. Provide tight, smooth laminations without wrinkles, ridges, buckles, kinks, and fishmouths. Completed system shall be free of air pockets, blisters, ridges, fishmouths, and open laps.

3.3.4 Flashings

Two piles of flashing are required. First ply of equal or greater thickness as the base sheet, and second ply of equal or greater thickness as the cap sheet. Apply granular surfaced modified bitumen sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, in accordance with membrane manufacturer's printed application instructions and where necessary to make the work watertight. Metal flashing collars and cap flashings are specified under Section 07 60 00, "Flashing and Sheet Metal." Do not set metal flashing in hot asphalt.

3.3.5 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.3.6 Protection of Applied Roofing Against Moisture Absorption

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system as follows.

3.3.6.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation boards and seal the terminated edge of modified bitumen roofing system with two full width strips of roofing felt set in and coated with asphalt roof cement. One-half width of the strips shall extend up and over the finished roofing and the other half-width extended out onto the bare deck unless recommended otherwise in membrane manufacturer's printed application instructions. Seal off flutes in metal decking along the cutoff edge. Pull membrane free/loose or cut to expose the insulation when resuming work, and remove the insulation boards used for fill-in.

3.3.6.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Temporary flashings shall consist of one ply of ply felt applied in a trowel coat of asphalt roof cement applied to a primed surface, and finished with a surface coat of asphalt roof cement. Remove temporary flashing before applying permanent flashing.

3.3.6.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.4 INFORMATION CARD

For each roof type, furnish a typewritten card, a photoengraved 0.032 inch thick aluminum card for exterior display. Card shall be 8 1/2 by 11 inches minimum and shall contain the information listed on Form 1 located at end of this section. Install card near point of access to roof, or as instructed by the Government.

FORM 1, ROOFING SYSTEM DESCRIPTION

1. Location _____ 2. Bldg. Name _____

3. Bldg. No. _____ 4. Roof Area (SF) _____ 5. Contract No. _____

6. New Construction: ( ) Yes ( ) No 7. Deck Slope: _____

8. Type of Deck:
   ( ) Metal
   ( ) Cast-In-Place Concrete
   ( ) Precast/Prestressed Concrete
   ( ) Wood Plank or Plywood
   ( ) Other _____

9. Type of Insulation Board:
   ( ) Polyisocyanurate/Composite
   ( ) Polystyrene/Composite
   ( ) Perlite
   ( ) Other _____
   ( ) Polyisocyanurate Foam
   ( ) Polystyrene
   ( ) Mineral Fiber

10. Insulation Manufacturer: _____

11. Insulation Thickness: _____

12. Vapor Treatment: Total coverage ( ) Yes ( ) No
    ( ) No Vapor Retarder
    ( ) One Way Roof Vents
    ( ) Other _____
    ( ) Bituminous Vapor Retarder
    ( ) Laminated Kraft Paper

13. Vapor Treatment Manufacturer(s): _____

14. Roofing Type:
    ( ) Built-Up (Asphalt)
    ( ) Built-Up (Coal-Tar)
    ( ) Metal
    ( ) Shingles
    ( ) PIB
    ( ) Modified Bitumen
    ( ) CSPE
    ( ) Other _____
    ( ) TPA
    ( ) EPDM
    ( ) PVC

15. Roofing Manufacturer: _____

16. Roofing Installer/Warrantor: _____

17. Roofing Application Method:
    ( ) Bitumen ( ) Fully Adhered ( ) Loose-Laid
    ( ) Mechanically Fastened ( ) Torched Ballasted
    ( ) Mechanically Fastened/Fully Adhered ( ) Other _____

18. Warranty Period: From _____ To _____

19. Warranty Serial Number: _____

20. Date Roofing Completed: _____ 21. Inspector: _____

22. Prime Contractor Name/Address: _____

Signature: _____ Date: _____

INSTRUCTIONS FOR FORM 1 (Do Not Post)

1. Location: Name of activity as shown on contract.

2. Bldg. Name: As shown on contract or as provided by Contracting Officer.

3. Bldg. Number: As provided by Contracting Officer.

4. Roof Area: Area in square feet of roof for which deck insulation, membrane, etc. are the same. A separate form is required if any part of roof system is different over other areas of the roof.

5. Contract Number: As shown on the contract.

7. Show deck slope.

8. Deck: Check appropriate block.

9. Type of Insulation Board: Check appropriate block.

11. Show minimum thickness of installed insulation.

12. Vapor Treatment: Check appropriate blocks.

13. Show vapor treatment system manufacturer's name.

14. Roofing Type: Check appropriate block.

15. Show roofing manufacturer's name.

16. Roofing Installer's or Contractor's name.

17. Roofing Application Method: Check appropriate block.

18. Warranty Period: Insert start and end dates.

20. Show date roofing was accepted by the Contracting Officer. Warranty period begins on this date.

21. Show Government Inspector's name.

22. Prime Contractor Name/Address/Signature: Must be signed and dated by QC Manager.

-- End of Section --

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M	(2008) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B101	(2007) Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B69	(2011) Standard Specification for Rolled Zinc
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 4586	(2007) Asphalt Roof Cement, Asbestos-Free
ASTM D41/D41M	(2011) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793 (2003) Architectural Sheet Metal Manual, 6th Edition

1.2 GENERAL REQUIREMENTS

Finished sheet metalwork will form a weathertight construction without waves, warps, buckles, fastening stresses or distortion, which allows for expansion and contraction. Sheet metal mechanic is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous roofing operations.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gutters;

Downspouts;

Expansion joints;

Gravel stops and fascias;

Splash pans;

Base flashing;

Counterflashing;

Flashing at roof penetrations;

Drip edge;

Eave flashing;

Indicate thicknesses, dimensions, fastenings and anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.4 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition as determined and instructed by the COR. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA Arch. Manual for a particular item, unless otherwise specified or indicated. Conform to the requirements specified and to the thicknesses and configurations established in SMACNA Arch. Manual for the materials. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items must be copper.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used except as follows:

2.1.1 Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fascias; cap, valley, steeped, base, and eave flashings, and related accessories.

2.1.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.1.3 Copper, Sheet and Strip

ASTM B370, cold-rolled temper, H 00 (standard).

2.1.4 Lead-Coated Copper Sheet

ASTM B101.

2.1.5 Lead Sheet

Minimum weight 4 pounds per square foot.

2.1.6 Steel Sheet, Zinc-Coated (Galvanized)

ASTM A653/A653M.

2.1.6.1 Finish

Exposed exterior items of zinc-coated steel sheet must have a baked-on, factory-applied color coating of polyvinylidene fluoride or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and

pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color to match adjacent material.

2.1.7 Zinc Sheet and Strip

ASTM B69, Type I, a minimum of 0.024 inch thick.

2.1.8 Stainless Steel

ASTM A167, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

2.1.9 Aluminum Alloy Sheet and Plate

ASTM B209 color to match adjacent material form alloy, and temper appropriate for use.

2.1.9.1 Alclad

When fabricated of aluminum, fabricate the items Alclad 3003, Alclad 3004, Alclad 3005, clad on both sides unless otherwise indicated.

a. Gutters, downspouts, and hangers

b. Gravel stops and fascias

c. Flashing

2.1.9.2 Finish

Exposed exterior sheet metal items of aluminum must have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color of to match adjacent material.

2.1.10 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B221.

2.1.11 Solder

ASTM B32, 95-5 tin-antimony.

2.1.12 Bituminous Plastic Cement

ASTM D 4586, Type I.

2.1.13 Roofing Felt

ASTM D 226/D 226M Type I.

2.1.14 Asphalt Primer

ASTM D41/D41M.

2.1.15 Fasteners

Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.2 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inch. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work.

3.1.3 Cleats

Provide cleats for sheet metal 18 inch and over in width. Space cleats evenly not over 12 inch on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of 2 inch wide by 3 inch long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. Pretin cleats for soldered seams.

3.1.4 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inch or less in thickness.

3.1.5 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.5.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

3.1.5.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

3.1.5.3 Loose-Lock Expansion Seams

Not less than 3 inch wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 1/8 inch thick bed.

3.1.5.4 Flat Seams

Make seams in the direction of the flow.

3.1.6 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pretin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.6.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pretinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.7 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.7.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

3.1.7.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inch maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inch from the end of the overlapping sheet.

3.1.8 Protection from Contact with Dissimilar Materials

3.1.8.1 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.8.2 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.8.3 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.9 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascias by expansion and contraction joints spaced not more than 12 feet apart.

3.1.10 Base Flashing

Extend up vertical surfaces of the flashing not less than 8 inch and not less than 4 inch under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 6 inch. Overlap the flashing strips with the previously laid flashing not less than 3 inch. Fasten the strips at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 6 inch on center with hex headed, galvanized shielded screws a minimum of 2-inch lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of curbs and similar vertical surfaces, extending through sloping roofs, the metal flashings. Extend the metal flashings onto the roof covering not less than 4.5 inch at the lower side of vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Provide factory-fabricated base flashing for interior and exterior corners.Do not use metal base flashing on built-up roofing.

3.1.11 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inch above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inch. Fold the exposed edges of counterflashings 1/2 inch. Where stepped counterflashings are required, they may be installed in short lengths a minimum 8 inch by 10 inch or may be of the preformed one-piece type. Provide end laps in counterflashings not less than 3 inch and make it

weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 10 feet. Form the flashings to the required shapes before installation. Factory-form the corners not less than 12 inch from the angle. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inch into the walls. Install counterflashing to provide a spring action against base flashing.

3.1.12 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1 1/4 inch, as approved.

3.1.12.1 Caulked Reglets

Provide with rounded edges and metal strap brackets or other anchors for securing to the concrete forms. Provide reglets with a core to protect them from injury during the installation. Provide built-up mitered corner pieces for internal and external angles.Wedge the flashing in the reglets with lead wedges every 18 inch, caulked full and solid with an approved compound.

3.1.12.2 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snaplock receiver. Insert the flashing the full depth of the slot and lock by indentations made with a dull-pointed tool, wedges, and filled with a sealant. For friction reglets, install flashing snaplock receivers at 24 inch on center maximum. When the flashing has been inserted the full depth, caulk the slot and lock and fill with sealant.

3.1.13 Metal Drip Edge

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inch and secure with compatible nails spaced not more than 10 inch on center along upper edge.

3.1.14 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation.Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in sections not less than 8 feet.Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inch minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets.Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on by cleats spaced not less than 36 inch apart. Adjust gutters to slope uniformly to outlets,

with high points occurring midway between outlets. Fabricate hangers and fastenings from metals.

3.1.15 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the masonry or steel substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

3.1.15.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

3.1.16 Splash Pans

Install splash pans where downspouts discharge on roof surfaces and at other locations as indicated. Unless otherwise shown, provide pans not less than 24 inches long by 18 inches wide with metal ribs across the bottom of the pan. Form the sides of the pan with vertical baffles not less than one inch high in the front, and 4 inches high in the back doubled over and formed continuous with horizontal roof flanges not less than 4 inches wide. Bend the rear flange of the pan to contour of cant strip and extend up 6 inches under the side wall covering or to height of base flashing under counterflashing. Bed the pans and roof flanges in plastic bituminous cement and strip-flash as specified.

3.1.17 Eave Flashing

One piece in width, applied in 8 to 10 foot lengths with expansion joints spaced as specified in paragraph entitled "Expansion and Contraction." Provide a 3/4 inch continuous fold in the upper edge of the sheet to engage cleats spaced not more than 10 inches on center. Locate the upper edge of flashing not less than 18 inch from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with one inch flat locked joints with cleats that are 10 inches on center.

3.1.18 Expansion Joints

Provide expansion joints for roofs, walls, and floors as indicated. Provide expansion joints in continuous sheet metal at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum, aluminum gravel stops and fascias which must have expansion joints at not more than 12 foot spacing. Provide evenly spaced joints. Provide an additional joint where the distance between the last expansion joint and the end of the continuous

run is more than half the required interval spacing. Conform to the requirements of Table I.

3.1.18.1 Roof Expansion Joints

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Bituminous base flashing is specified in Roofing Section. Provide counterflashing as specified in paragraph "Counterflashing," except as follows: Provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than one inch for flashing on one side of the expansion joint and be less than the width of the expansion joint plus one inch for flashing on the other side of the joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

3.1.19 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck. Goose-necks, rainhoods, and power roof ventilators are specified in 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS.

3.1.20 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inch on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inch. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inch roof flange in bituminous plastic cement and nailed 3 inch on center. Extend sleeve a minimum of 8 inch above the roof deck and lapped a minimum of 3 inch by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

3.2 PAINTING

Field-paint sheet metal for separation of dissimilar materials.

3.2.1 Aluminum Surfaces

Shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification that specified material is provided and installed.

c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

Sheet Metal Items	Aluminum, Inch	Stainless Steel, Inch	Zinc-Coated Steel, U.S. Std. Gage
Building Expansion Joints			
Cover.....	.032	.015	24
Downspouts and leaders	.032	.015	24
Downspout clips and anchors	.040 clip	-	-
	.125 anchor	-	-
Downspout straps, 2-inch	.060	.050	-
Flashings:			
Base	.040	.018	24
Cap (Counter-flashing)	.032	.015	26
Eave	-	.015	24
Pipe vent sleeve(d)			

Gravel stops and fascias:			
Extrusions	.075	-	-
Sheets, smooth	.050	.018	24
Edge strip	.050	.025	-
Gutters:			
Gutter section.....	.032	.015	24
Continuous cleat.....	.032	.015	24
Hangers, dimensions	1 inch by .080 inch (c)	1 inch by .037 inch	-
Joint Cover plates... (See Table II)	.032	.015	24
Reglets (c)	-	.010	-
Splash pans	.040	.018	-

(a) Brass.

(b) May be lead weighing 4 pounds per square foot.

(c) May be polyvinyl chloride.

(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph entitled "Single Pipe Vents" for optional material.

TABLE II. SHEET METAL JOINTS

Item Designation	TYPE OF JOINT		
	Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	1.25 inch single lock, standing seam, cleated	1.25 inch single lock, standing	- - -
Flashings			
Base	One inch 3 inch lap for expansion joint	One inch flat locked, soldered; sealed; 3 inch lap for expansion joint	Aluminum producer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound

			compound.
Cap-in reglet	3 inch lap	3 inch lap	Seal groove with joint sealing compound.
Reglets	Butt joint	- - -	Seal reglet groove with joint sealing compound.
Eave	One inch flat locked, cleated One inch loose locked, expansion joint cleated	One inch flat locked, locked, cleated one inch loose locked, sealed expansion joints, cleated	Same as base flashing.
Edge strip	Butt	Butt	- - -
Gravel stops:			
Extrusions	- - -	Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing backup plate.
Gutters	1.5 inch lap, riveted and soldered	One inch flat locked, riveted, and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.

(a) Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.

(b) Seal polyvinyl chloride reglet with manufacturer's recommended sealant.

-- End of Section --

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 119	(2011) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E 1399	(1997; R 2009) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E 1966	(2007) Fire-Resistive Joint Systems
ASTM E 2174	(2010a) Standard Practice for On-Site Inspection of Installed Fire Stops
ASTM E 2307	(2010) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E 2393	(2010a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
ASTM E 814	(2011a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
FM AS 4991	(2001) Approval of Firestop Contractors

UNDERWRITERS LABORATORIES (UL)

UL 1479	(2003; Reprint Mar 2010) Fire Tests of Through-Penetration Firestops

UL 2079	(2004; Reprint Jun 2008) Tests for Fire Resistance of Building Joint Systems
UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 General

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.

b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2.2 Sequencing

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.2.3 Submittals Requirements

a. Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are

to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

b. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification from UL of passing the "Aging and Environmental Exposure Testing " portion of UL 1479.

c. Submit documentation of training and experience for Installer.

d. Submit manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials;

SD-07 Certificates

Firestopping Materials

Installer Qualifications;

Inspection;

1.4 QUALITY ASSURANCE

1.4.1 Installer

Engage an experienced Installer who is:

a. FM Research approved in accordance with FM AS 4991, operating as a UL Certified Firestop Contractor, or

b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer written certification of training, and retain proof of certification for duration of firestop installation.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements. Remove damaged or deteriorated materials from the site.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic, water-based, noncombustible products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment. Firestop material must be free from Ethylene Glycol, PCB, MEK, or other types of hazardous chemicals.

2.1.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SYSTEM DESCRIPTION, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = Rating of wall or partition being penetrated.

b. Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = 1 hour, T Rating = 1 hour. Where the penetrating item is outside of a wall cavity the F rating and T rating must be equal to the fire resistance rating of the floor penetrated.

c. Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = 1 hour, T Rating = 1 hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SYSTEM DESCRIPTION, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur, as follows: construction joints in walls, 1 hour; construction joints in floors, 1 hour; gaps between floor slabs and curtain walls, 1 hour; gaps between top of the walls and the bottom of roof and floor decks, 1 hour, and provide L rating of <5 cfm/lf where required. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E 2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.1.4 Material Performance

All firestop materials are subject to these minimum standards of performance.

a. Firestop material shall be capable of installation at temperatures of 35 to 120 degrees F.

b. Material must be able to be frozen, thawed and still maintain manufacturer approval for installation.

c. Firestop material must convey a manufacturer's written warranty guaranteeing the performance of the material for the sustainable lifetime of the structure.

d. Material must maintain a shelf life of no less than 2 years form date of manufacturing.

e. Acceptable firestop cast-in-place devices are factory assembled intumescent lined round or oval plastic cylinders capable of protecting plastic, metallic, cable, and blank openings through the cast-in-place device equal to the fire-resistance rating of the floor.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products. Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0% to 100% visual fill of penetrants; while maintaining "L" rating of <5 cfm/sf measured at ambient temperature and 400* F at 0% to 100% visual fill. Each device must be capable of retrofit applications and be available in square and round configurations, with single, double, triple and six-plex bracket systems provided. Firestop devices must also allow for plastic pipe, metallic pipe, and mixed multiple

penetrations plastic, metallic, insulated metallic, and cable through a single device.

3.3 INSPECTION

3.3.1 General Requirements

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the manufacturer's technical representative. The manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.3.2 Inspection Standards

Inspect all firestopping in accordance to ASTM standards for firestop inspection, and document inspection results to be submitted to the Owner.

a. ASTM E 2393

b. ASTM E 2174

-- End of Section --

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C734	(2006) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C919	(2008) Use of Sealants in Acoustical Applications
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 217	(2010) Cone Penetration of Lubricating Grease
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). Provide a copy of the Material Safety Data Sheet for each solvent, primer or sealant material.

SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 90 degrees F or less than 0 degrees F.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility with Substrate

Verify that each of the sealants is compatible for use with joint substrates.

1.5.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6 SPECIAL WARRANTY

Guarantee sealant joint against failure of sealant and against water penetration through each sealed joint for five years.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

2.1.1 Interior Sealant

Provide ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant for the following:

	LOCATION	COLOR
a.	Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.	Match adjacent surface color
b.	Perimeter of frames at doors, windows and access panels which adjoin exposed	Match adjacent surface color

interior concrete and masonry surfaces.

c.	Joints between edge members for acoustical tile and adjoining vertical surfaces.	Match adjacent surface color
d.	Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	Match adjacent surface color
e.	Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	Match adjacent surface color
f.	Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	Match adjacent surface color

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

	LOCATION	COLOR
a.	Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b.	Joints between new and existing exterior masonry walls.	Match adjacent Surface color
c.	Masonry joints where shelf angles occur.	Match adjacent surface color
d.	Expansion and control joints.	Match adjacent surface color
e.	Voids where items pass through exterior walls.	Match adjacent surface color
f.	Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match adjacent surface color
g.	Metal-to-metal joints where sealant is indicated or specified.	Match adjacent surface color
h.	Joints between ends of gravel stops, fascias, copings, and adjacent walls.	Match adjacent surface color

2.1.3 Floor Joint Sealant

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

	LOCATION	COLOR
a.	Seats of metal thresholds for exterior doors.	Gray
b.	Control and expansion joints in floors, slabs, ceramic tile, and walkways.	Gray

2.1.4 Acoustical Sealant

Rubber or polymer-based acoustical sealant conforming to ASTM C919 must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant must have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734, and must be non-staining.

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 BACKSTOPS

Provide glass fiber roving or polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Make backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.4.1 Rubber

Conform to ASTM D 1056, Type 2, closed cell, Class A, Grade NS, round cross section for cellular rubber sponge backing.

2.4.2 Synthetic Rubber

Conform to ASTM C509, Option I, Type I preformed rods or tubes for Synthetic rubber backing.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean surfaces from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, contact sealant manufacturer for specific recommendations.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity.

3.1.4 Wood Surfaces

Keep wood surfaces to be in contact with sealants free of splinters and sawdust or other loose particles.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

a. Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry,		

stone:

1/4 inch (minimum)	1/4 inch	1/4 inch
Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
Over 1/2 inch to 2 inch	1/2 inch	5/8 inch
Over 2 inch.	(As recommended by sealant manufacturer)	

b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is not required on metal surfaces.

3.3.2 Masking Tape

Place masking tape on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Remove masking tape within 10 minutes after joint has been filled and tooled.

3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

a. Where indicated.

b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios".

3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and cannot be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the

joints solidly without air pockets. Tool sealant after application to ensure adhesion. Make sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Apply sealer over the sealant when and as specified by the sealant manufacturer.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- End of Section --

SECTION 08 11 13 STEEL

DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A879/A879M	(2006) Standard Specification for Steel Sheet, zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C578	(2011a) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2011) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM D2863	(2010) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115	(2006) Hardware Preparation in Steel Doors and Steel Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105	(2010) Standard for Installation of Smoke Door Assemblies and Other Opening Protectives
NFPA 252	(2008) Standard Methods of Fire Tests of Door Assemblies
NFPA 80	(2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111	(2009) Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories
SDI/DOOR 113	(2001; R2006) Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies
SDI/DOOR A250.11	(2001) Recommended Erection Instructions for Steel Frames
SDI/DOOR A250.3	(2007) Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
SDI/DOOR A250.4	(2001) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
SDI/DOOR A250.6	(2003; R2009) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
SDI/DOOR A250.8	(2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C	(2009) Standard for Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors;

Frames;

Weatherstripping

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors;

Schedule of frames;

Submit door and frame locations.

SD-03 Product Data

Doors;

Frames;

Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated. Provide exterior glazing in accordance with ASTM F 2248 and ASTM E1300.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors and for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

2.1.1.2 Maximum Duty Doors

SDI/DOOR A250.8, Level 4, physical performance Level A, Model 1 with core construction as required by the manufacturer for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level 4 at all exterior doors.

2.2 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with SDI/DOOR A250.4 and shall have met the requirements for Level C. Prepare doors to receive specified hardware.Doors shall be 1-3/4 inch thick. Provide insulated steel doors and frames at all exterior doors.

2.3 ACCESSORIES

2.3.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors. For interior pairs of fire rated and smoke control doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies and NFPA 105 for smoke control assemblies.

2.3.2 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or

b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or

c. Mineral board: ASTM C612, Type I.

2.5 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 3 and 4, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth. Provide at all exterior doors.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

2.5.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.5.3 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and be a member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.5.4 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.5.5 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.5.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;

b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;

c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111; and

2.5.6.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

2.6 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 shall take precedence over details indicated or specified.

2.6.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.6.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

2.6.3 Astragal on Fire and Smoke Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. On smoke control doors, conform to NFPA 105.

2.7 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

2.7.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08 71 00 DOOR HARDWARE. Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.8 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.9 FINISHES

2.9.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8, or paintable A25 galvannealed steel without primer. Where coating is removed by welding, apply touchup of factory primer.

2.9.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A924/A924Mand ASTM A653/A653M. The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8. Provide for exterior doors.

2.9.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A879/A879M, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

2.9.4 Factory-Applied Enamel Finish

Coatings shall meet test procedures and acceptance criteria in accordance with SDI/DOOR A250.3. After factory priming, apply two coats of medium-gloss enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements shall be in accordance with the

coating manufacturer's recommendations. Color(s) of finish coat shall be as indicated and shall match approved color sample(s).

2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

2.11 PROVISIONS FOR GLAZING

Materials are specified in Section 08 81 00, GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. Backfill frames with mortar. Coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean

thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

SECTION 08 11 16 ALUMINUM

DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural

Exterior doors, frames and hardware shall be designed to resist equivalent static design loads in accordance with ASTM F 1642. Frame deflections shall not exceed L/160 of the unsupported member lengths. Equivalent static design loads for connections of window or door frame to the surrounding walls or hardware and associated connections, and glazing stop connections shall be in accordance with ASTM F 2248 and ASTM E1300.Design supporting elements and their connections based on their ultimate capacities. Provide calculations of a Professional Engineer that substantiates compliance with these requirements. Use frames that provide an equivalent level of performance. Shapes and thicknesses of framing members shall be sufficient to withstand a design wind load of not less than50 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide glazing beads, moldings, and trim of not less than 0.050 inch nominal thickness.

1.2.2 Air Infiltration

When tested in accordance with ASTM E283, air infiltration shall not exceed 0.06 cubic feet per minute per square footof fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).

1.2.3 Water Penetration

When tested in accordance with ASTM E331, there shall be no water penetration at a pressure of 8 pounds per square foot of fixed area.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors, windows and frames;

Show elevations of each door type, size of doors and frames, metal gages, details of door and frame construction, methods of anchorage, glazing details, weatherstripping, provisions for and location of hardware, and details of installation.

SD-04 Samples

Finish sample;

SD-05 Design Data

Structural calculations for deflection;

SD-08 Manufacturer's Instructions

Doors and frames

Submit detail specifications and instructions for installation, adjustments, cleaning, and maintenance.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on nonabsorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

1.5 QUALITY CONTROL

1.5.1 Shop Drawing Requirements

Drawings shall indicate elevations of doors, windows and frames, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, trim, installation details, and other related items.

1.5.2 Sample Requirements

1.5.2.1 Finish Sample Requirements

Submit color chart of standard factory-finish color coatings.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members, subframes, adjoining sidelights, adjoining window wall, trim, and accessories.

2.2 MATERIALS

2.2.1 Anchors

Stainless steel.

2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.2.3 Aluminum Alloy for Doors and Frames

ASTM B221, Alloy 6063-T5 for extrusions. ASTM B209, alloy and temper best suited for aluminum sheets and strips.

2.2.4 Fasteners

Hard aluminum or stainless steel.

2.2.5 Structural Steel

ASTM A36/A36M.

2.2.6 Aluminum Paint

Aluminum door manufacturer's standard aluminum paint.

2.3 FABRICATION

2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 12 inches on center. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

2.3.2 Aluminum Doors

Of type, size, and design indicated and not less than 1-3/4 inch thick. Minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal and shall include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor. Bevel single-acting doors 0.063 or 0.125 inch at lock, hinge, and meeting stile edges.

2.3.2.1 Full Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 3/8 or 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Weld concealed reinforcements for hardware in place.

2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively. Air leakage of a single leaf weatherstripped door shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill. Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation. Place anchors near top and bottom of each jamb and at intermediate points not more than 25 inch apart.

2.3.6 Provisions for Hardware

Coordinate with Section 08 71 00 DOOR HARDWARE. Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws.

2.3.7 Provisions for Glazing

Provide extruded aluminum snap-in glazing beads on interior side of doors. Glazing beads shall have vinyl insert glazing gaskets. Design glazing beads to receive glass of thickness indicated or specified.

2.3.8 Finishes

Provide exposed aluminum surfaces with factory finish of anodic coating.

2.3.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45. Finish shall be clear (natural), designation AA-M10-C22-A41, Architectural Class I 0.7 mil or thicker).

PART 3 EXECUTION

3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors, adjoining sidelights, and adjoining window walls. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions. Anchor bottom of each frame to rough floor construction with 3/32 inch thick stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Hang doors to produce clearances specified in paragraph entitled "Aluminum Doors," of this section. After erection and glazing, adjust doors and hardware to operate properly.

3.2 PROTECTION FROM DISSIMILAR MATERIALS

3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact to dissimilar metals.

3.2.1.1 Protection

Provide one of the following systems to protect surfaces in contact with dissimilar metals:

a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.

b. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.

c. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.

d. Use a nonabsorptive tape or gasket in permanently dry locations.

3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint to prevent aluminum discoloration.

3.2.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

3.2.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting the aluminum, the Contractor shall have the option of painting the wood or other absorptive surface with two coats of aluminum paint and sealing the joints with elastomeric sealant.

3.3 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's written recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

3.4 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10	(2010; Change 2010; Change 2011) Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE FUN IP	(2009; Errata 2010) Fundamentals Handbook, I-P Edition

ASME INTERNATIONAL (ASME)

ASME B29.400	(2001; R 2008) Combination, "H" Type Mill Chains, and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A27/A27M	(2010) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A48/A48M	(2003; R 2008) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666	(2010) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F 568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA MG 1	(2009) Motors and Generators
NEMA ST 1	(1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 DESCRIPTION

Overhead coiling doors to be counterbalanced doors by methods of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members. Doors to be coiling type, with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Wind Loading

Design and fabricate door assembly to withstand the wind loading pressure of at least 50 pounds per square foot with a maximum deflection of 1/120 of the opening width. Provide test data showing compliance with ASTM E 330. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested Complete assembly must meet or exceed the requirements of ASCE 7-10.

1.3.2 Operational Cycle Life

All portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue must be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Provide fabrication drawings that show complete assembly with hardware and framing details for the following items:

Overhead Coiling Doors

Counterbalancing Mechanism

Manual Door Operators

Electric Door Operators

Bottom Bar

Guides

Mounting Brackets

Overhead Drum

Hood

Painting

Submit Installation Drawings in accordance with paragraph entitled, "Overhead Coiling Door Assemblies," of this section.

SD-03 Product Data

Submit manufacturer's catalog data for the following items listing all accessories including supports, locks and latches, and weather stripping.

Overhead Coiling Doors

Manual Door Operators

Electric Door Operators

Fire-Rated Door Assembly

SD-05 Design Data

Submit equipment and performance data for the following items in accordance with the paragraph entitled, "Performance Requirements," of this section.

Overhead Coiling Doors

Manual Door Operators

Electric Door Operators

Fire-Rated Door

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies.

1.5 OVERHEAD COILING DOOR DETAIL SHOP DRAWINGS

Provide installation drawings for overhead coiling door assemblies which show elevations of each door type, shape and thickness of materials, finishes, details of joints and connections, and details of guides and fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Show locations of replaceable fusible links wiring diagrams for power, signal and controls. Include a schedule showing the location of each door with the drawings.

Contractor must submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the Overhead Coiling Door Assemblies. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

Provide operation and maintenance manuals which are consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Provide test data that is legible and of good quality.

1.6 WARRANTY, OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies, including the following items:

Materials

Devices

Manual Door Operators

Electric Door Operators

Hood

Procedures

Manufacture's Brochures

Parts Lists

Contractor must furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship and that they will remain so for not less than two years after completion and acceptance of the project.

Contractor must warrant that upon notification by the Government, he will immediately make good any defects in material, workmanship, and door operation within the same time period covered by the guarantee, at no cost to the Government.

1.7 DELIVERY AND STORAGE

Delivered doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

PART 2 PRODUCTS

2.1 OVERHEAD COILING DOORS

2.1.1 Curtain Materials and Construction

Provide curtain slats which are fabricated from steel sheets conforming to ASTM A653/A653M, Grade A, with the additional requirement of a minimum yield point of 33,000 psi. Provide sheets which are galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M.

Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Provide slats which are continuous without splices for the width of the door.

Provide slats filled with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces on interior surface of slats.

2.1.2 Insulated Curtains

Form Curtains from manufacturer's standard shapes of interlocking slats. Supply slat system with a minimum R-value of 4 when calculated in accordance with ASHRAE FUN IP. Slats to consist of a polystyrene core not less than 11/16 inch thick, completely enclosed within metal facings. Exterior face of slats must be the same gauge as specified for curtains.

Interior face must be not lighter than 0.0219 inches. The insulated slat assembly is to have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.

2.1.3 Curtain Bottom Bar

Curtain bottom bars must be pairs of angles from the manufacturer's standard steel, stainless and aluminum extrusions not less than 2.0 by 2.0 inches by 0.188 inch.Steel extrusions must conform to ASTM A36/A36M. Stainless steel extrusions conforming to ASTM A666, Type 304. Galvanize angles and fasteners in accordance with ASTM A653/A653M and ASTM A924/A924M. Coat welds and abrasions with paint conforming to ASTM A780/A780M.

2.1.4 Locks

Provide end and/or wind locks of cast steel conforming to ASTM A27/A27M, Grade B; galvanized in accordance with ASTM A653/A653M, ASTM A153/A153M and ASTM A924/A924M and secured at every other curtain slat.

2.1.5 Weather Stripping

Weather-stripping at the door-head and jambmust be 1/8-inch thick sheet of natural or neoprene rubber with air baffles, secured to the insides of hoods with galvanized-steel fasteners through continuous galvanized-steel pressure bars at least 5/8-inch wide and 1/8-inch thick.

Threshold weather-stripping must be 1/8-inch thick sheet natural or neoprene rubber secured to the bottom bars.

Provide weather-stripping of natural or neoprene rubber conforming to ASTM D 2000.

2.1.6 Locking Devices

Slide Bolt to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

Locking Device Assembly which includes cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

Provide Chain Lock Keeper which suitable for a standard padlock.

2.1.7 Safety Interlock

Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.1.8 Overhead Drum

Fabricate drums from nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.

2.2 HARDWARE

All hardware must conform to ASTM A153/A153M, ASTM A307, ASTM F 568M, and ASTM A27/A27M.

2.2.1 Guides

Fabricate curtain jamb guides from the manufacturer's standard angles or channels of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for track adjustment.

2.2.2 Equipment Supports

Fabricate door-operating equipment supports from the manufacturer's standard steel shapes and plates conforming to ASTM A36/A36M, galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M. Size the shapes and plates in accordance with the industry standards for the size, weight, and type of door installation.

2.3 COUNTERBALANCING MECHANISM

Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

2.3.1 Brackets

Provide the manufacturer's standard mounting brackets of either cast iron or cold-rolled steel with one located at each end of the counterbalance barrel conforming to ASTM A48/A48M.

2.3.2 Counterbalance Barrels

Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 inch per foot of span under full load.

2.3.3 Spring Balance

One or more oil-tempered, heat-treated steel helical torsion springs installed within the barrel capable of producing sufficient torque to assure easy operation of the door curtain. Provide and size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

2.3.4 Torsion Rod for Counter Balance

Fabricate rod from the manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

2.4 MANUAL DOOR OPERATORS

2.4.1 Manual Chain-Hoist Door Operators

Provide door operators which consist of an endless steel hand chain, chain-pocket wheel, guard, and a geared reduction unit of at least a 3 to 1 ratio with a maximum 25 lbf required pull for operation must not exceed 35 pounds.

Provide chain hoists to have a self-locking mechanism allowing the curtain to be stopped at any point in its upward or downward travel and to remain in that position until moved to the fully open or closed position. Provide hand chains of cadmium-plated alloy steel conforming to ASME B29.400. Yield point of the chain must be at least three times the required hand-chain pull.

Provide chain sprocket wheels of cast iron conforming to ASTM A48/A48M.

2.5 ELECTRIC DOOR OPERATORS

Provide electrical wiring and door operating controls conforming to the applicable requirements of NFPA 70.

Electric door-operator assemblies must be the sizes and capacities recommended and provided by the door manufacturer for specified doors. Assemblies must be complete with electric motors and factory-prewired motor controls, starter, gear reduction units, solenoid-operated brakes, clutch, remote-control stations, manual or automatic control devices, and accessories as required for proper operation of the doors.

Design the operators so that motors may be removed without disturbing the limit-switch adjustment and affecting the emergency auxiliary operators.

Provide a manual operator of crank-gear or chain-gear mechanisms with a release clutch to permit manual operation of doors in case of power failure. Arrange the emergency manual operator so that it may be put into and out of operation from floor level, and its use will not affect the adjustment of the limit switches. Provide an electrical or mechanical device which will automatically disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged.

2.5.1 Door-Operator Types

Provide an operator which is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

Provide an operator which is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

2.5.2 Electric Motors

Provide motors which are the high-starting-torque, reversible, constant-duty electrical type with overload protection of sufficient torque and horsepower to move the door in either direction from any position and produce a door-

travel speed of not less than 8 nor more than 12 inches per second without exceeding the horsepower rating.

Provide motors which conform to NEMA MG 1 designation, temperature rating, service factor, enclosure type, and efficiency to the requirements specified.

2.5.3 Motor Bearings

Bearings must be bronze-sleeve or heavy-duty ball or roller antifriction type with full provisions for the type of thrust imposed by the specific duty load.

Pre-lubricate and factory seal bearings in motors less than 1/2 horsepower.

Equip motors coupled to worm-gear reduction units with either ball or roller bearings.

Equip bearings in motors 1/2 horsepower or larger with lubrication service fittings. Fit lubrication fittings with color-coded plastic or metal dust caps.

In any motor, bearings that are lubricated at the factory for extended duty periods do not need to be lubricated for a given number of operating hours. Display this information on an appropriate tag or label on the motor with instructions for lubrication cycle maintenance.

2.5.4 Motor Starters, Controls, and Enclosures

Each door motor must have a factory-wired, unfused, disconnect switch; a reversing, across-the-line magnetic starter with thermal overload protection; 120-volt operating coils with a control transformer limit switch; and a safety interlock assembled in a NEMA ICS 6 type enclosure as specified herein. Control equipment must conform to NEMA ICS 2.

Provide adjustable switches, electrically interlocked with the motor controls and set to stop the door automatically at the fully open and fully closed position.

2.5.5 Control Enclosures

Provide control enclosures that conform to NEMA ICS 6 for oil-tight and dust-tight NEMA Type 13.

2.5.6 Transformer

Provide starters with 230/460 to 115 volt control transformers with one secondary fuse when it is required to reduce the voltage on control circuits to 120 volts or less. Provide transformer that conforms to NEMA ST 1.

2.5.7 Safety-Edge Device

Provide each door with a pneumatic safety device extending the full width of the door and located within a U-section neoprene or rubber astragal mounted on the bottom rail of the bottom door section. Device must immediately stop and reverse the door upon contact with an obstruction in the door opening

during downward travel and cause the door to return to full-open position. Safety device is not a substitute for a limit switch.

Connect safety device to the control circuit through a retracting safety cord and reel.

2.5.8 Remote-Control Stations

Provide interior remote control stations which are full-guarded, momentary-contact three-button, heavy-duty, surface-mounted NEMA ICS 6 type enclosures as specified. Mark buttons "OPEN," "CLOSE," and "STOP." The "CLOSE" button must be the type requiring a constant pressure to maintain the closing motion of the door. When the door is in motion and the "STOP" button is pressed, the door must stop instantly and remain in the stopped position; from the stopped position, the door may then be operated in either direction.

2.5.9 Speed-Reduction Units

Provide speed-reduction units consisting of hardened-steel worm and bronze worm gear assemblies running in oil or grease and encased in a sealed casing, coupled to the motor through a flexible coupling. Drive shafts must rotate on ball- or roller-bearing assemblies that are integral with the unit.

Provide minimum ratings of speed reduction units which are in accordance with AGMA provisions for class of service.

Ground worm gears to provide accurate thread form; machine teeth for all other types of gearing. Surface harden all gears.

Provide bearings which are the antifriction type equipped with oil seals.

2.5.10 Chain Drives

Provide roller chains that are power-transmission series steel roller type conforming to ASME B29.400, with a minimum safety factor of 10 times the design load.

Roller-chain side bars, rollers, pins, and bushings must be heat-treated or otherwise hardened.

Provide chain sprockets that are high-carbon steel with machine-cut hardened teeth, finished bore and keyseat, and hollow-head setscrews.

2.5.11 Brakes

Provide brakes which are 360-degree shoe brakes or shoe and drum brakes, solenoid-operated and electrically interlocked to the control circuit to set automatically when power is interrupted.

2.5.12 Clutches

Clutches must be the 4-inch diameter, multiple face, externally adjustable friction type or adjustable centrifugal type.

2.6 SURFACE FINISHING

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 GENERAL

Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, doors must be free from all distortion.

Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the contract documents and as required by the manufacturer.

Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

3.2 FIELD PAINTED FINISH

Steel doors and frames which are to be field painted must accordance with Section 09 90 00 PAINTS AND COATINGS and manufacturer's written instructions. Protect weather stripping from paint. Finishes must be free of scratches or other blemishes.

3.3 ACCEPTANCE PROVISIONS

After installation, adjust hardware and moving parts. Lubricate bearings and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

Adjust seals to provide weather-tight fit around entire perimeter.

Engage a factory-authorized service representative to perform startup service and checks according to manufacturer's written instructions.

Test the door opening and closing operation when activated by controls or alarm-connected fire-release system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset door-closing mechanism after successful test.

Test and make final adjustment of new doors at no additional cost to the Government.

3.3.1 Maintenance and Adjustment

Not more than 90 calendar days after completion and acceptance of the project, the Contractor must examine, lubricate, test, and re-adjust doors as required for proper operation.

3.3.2 CLEANING

Clean doors in accordance with manufacturer's approved instructions.

-- End of Section --

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

This Specification includes aluminum entrances, glass and glazing, door hardware, and components.

Type of Aluminum Entrance includes:

Impact Resistance Entrances; medium stile, 3-1/2 inch vertical face dimension, 1-3/4 inch depth, interior structural silicone glazed, high traffic/impact resistant applications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1503	(2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
AAMA 501	(2005) Methods of Test for Exterior Walls
AAMA 503	(2008) Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems
AAMA 800	(2010) Voluntary Specifications and Test Methods for Sealants

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2009; Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10	(2010; Change 2010; Change 2011) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B221M	(2007) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM E 1105	(2000; R 2008) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
ASTM E 1424	(1991; R 2008) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen
ASTM E 1886	(2005) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 783	(2002; R 2010) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.10	(2011) Power Operated Pedestrian Doors
ANSI/BHMA A156.4	(2008) Door Controls - Closers

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201 Safety Standard for Architectural Glazing Materials

UNDERWRITERS LABORATORIES (UL)

UL 325 (2002; Reprint Apr 2011) Door, Drapery, Gate, Louver, and Window Operators and Systems

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Entrance Performance Requirements

1.3.1.1 Air Infiltration

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. For single acting offset pivot, butt hung or continuous geared hinge entrances in the closed and locked position, test the specimen in accordance with ANSI/BHMA A156.10, and ASTM E 283 at a pressure differential of 1.57 psf for pairs of doors; maximum infiltration for a pair of 7 foot - 0 inch by 8 foot - 0 inch entrance doors and frame is 1.2 cfm/ft2.

b. Maximum allowable infiltration, for a completed storefront system is not to exceed 0.06 cfm/square foot when tested in accordance with ASTM E 1424 at differential static pressure of 6.24 psf.

1.3.1.2 Wind Loads

Provide completed storefront system capable of withstanding wind pressure loads, normal to the wall plane indicated, as follows:

a. Exterior Walls

(1) Positive Pressure: 50 psf

(2) Negative Pressure: 30 psf

b. Interior Walls: (pressure acting in either direction) 5 psf

1.3.1.3 Deflection

Submit certified test reports showing compliance with specified performance characteristics as follows:

The maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures is L/175 or 3/4 inches maximum.

1.3.1.4 Condensation Resistance and Thermal Transmittance Performance Requirements

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. U-Value Requirements:

(1) Perform test in accordance with AAMA 1503 procedure and on the configuration specified therein.

(2) Thermal Transmittance ("U" Value) maximum 0.65 (6250) BTU/hr/sf/deg F at 15 mph exterior wind.

b. CRF Class Requirements:

(1) Perform test in accordance with AAMA 1503.

(2) Condensation Resistance Factor Requirements (CRF) minimum 42.

1.3.1.5 Water Infiltration

Submit certified test reports showing compliance with specified performance characteristics as follows:

System is designed to provide no uncontrolled water when tested in accordance with ASTM E 331 at a static pressure of 8 psf.

1.3.2 Structural

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. Corner strength per dual moment load test procedure and obtain certification by an independent testing laboratory to ensure weld compliance and corner integrity.

b. Test and certify test results per AAMA 503, ASTM E 1105, ASTM E 783, ASTM E 331, and make available upon request.

1.3.2.1 Uniform Load

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. Apply a static air design load of (<MET>3.11 kilopascal for</MET> 85 psf (65 psf for 9/16 inch laminated infill) in the positive and negative direction in accordance with AAMA 501, and ASTM E 330.

b. No deflections are allowed to exceed l/180 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage is allowed.

1.3.2.2 Impact Resistance

Submit certified test reports showing compliance with specified performance characteristics as follows:

Large Missile, tested in accordance with ASTM E 1886 at a door opening of 7 foot - 0 inch by 8 foot - 0 inch.

1.3.2.3 Forced Entry

Submit certified test reports showing compliance with specified performance characteristics as follows:

Test in accordance with ASTM F 1642

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Sample Warranty;

Listing of Product Installations;

SD-02 Shop Drawings

Installation Drawings;

SD-03 Product Data

Manufacturer's Catalog Data

SD-04 Samples

Finish and Color Samples;

SD-06 Test Reports

Certified Test Reports;

SD-07 Certificates

Manufacturer's Product Warranty;

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Installer Qualifications

Provide documentation of Installer experience to perform work of this section, who has specialized in the installation of work similar to that required for this project, and who is acceptable to product manufacturer.

1.5.1.2 Manufacturer Qualifications

Ensure manufacturer is capable of providing field service representation during construction, approving acceptable installer and approving application method.

1.5.2 Pre-Installation Meetings

Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.5.3 Single Source Responsibility

Provide design, structural engineering, and custom fabrication for door portal system and supply of all components, materials, and products based on a single manufacturer of sole responsibility. Provision of products from numerous sources for site assembly without complete single source design and supply responsibility is not acceptable. Work items and components to be fabricated or supplied by single source are:

a. Door assemblies.

b. Glazed wall to be constructed around door portal as specified in this Section.

c. Door operating hardware to be installed on or within door portal as specified in Section 08 71 00 DOOR HARDWARE.

d. Glass as specified in Section 08 81 00 GLAZING.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Ordering

Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

1.6.2 Packing, Shipping, Handling and Unloading

Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.6.3 Storage and Protection

Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

1.7 PROJECT CONDITIONS/ SITE CONDITIONS

1.7.1 Field Measurements

Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication scheduled with construction progress to avoid construction delays.

1.8 DESIGN AND PERFORMANCE CRITERIA

Design, size components, and install door portal system to withstand these loads without breakage, loss, failure of seals, product deterioration, and other defects.

a. Dead and Live Loads: Determined by ASCE 7-10 and calculated in accordance with applicable codes.

b. Seismic loads: Design and install system to comply with applicable seismic requirements for project location as defined by Section 1613 of the International Building Code (IBC).

c. Effects of applicable wind load acting inward and outward normal to plane of wall in accordance with ASTM E 330.

d. Thermal loads and movement:

(1) Ambient temperature range: 120 degrees F.

(2) Material surfaces range: 180 degrees F.

e. Provide and install weatherstripping, exterior gaskets, sealants, and other accessories to resist water and air penetration.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum (Entrances and Components)

2.1.1.1 Material Standard

ASTM B221 ASTM B221M; 6063-T5 alloy and tempered

Provide door stile and rail face dimensions of the entrance doors as follows:

Vertical Stile	Top Rail	Bottom Rail
3-1/2 inches	3-1/2 inches	6-1/2 inches

Provide major portions of the door members at.125 inches nominal in thickness and glazing molding to be .050 inches thick.

2.1.1.2 Tolerances

Reference to tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by The Aluminum Association.

Provide either EPDM elastomeric extrusions or thermoplastic elastomer glazing gaskets. Structural silicone sealant is required.

2.2 MANUFACTURERS

Manufacturers are acceptable providing they meet the requirements specified in this section and project drawings.

2.3 ACCESSORIES

2.3.1 Fasteners

Provide stainless steel where exposed.

2.3.2 Perimeter Anchors

When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

2.3.3 Standard Entrance Hardware

2.3.3.1 Weatherstripping

Equip meeting stiles on pairs of doors with an adjustable astragal utilizing wool pile with polymeric fin.

Provide door weatherstripping on a single acting offset pivot or butt hung door and frame (single or pairs) comprised of a thermoplastic elastomer weatherstripping on a tubular shape with a semi-rigid polymeric backing.

Provide Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Provide as necessary to meet specified performance tests.)

2.3.3.2 Threshold

Provide extruded aluminum threshold, one piece per door opening, with ribbed surface.

2.3.3.3 Offset Pivots

Provide manufacturer's standard top and bottom pivots with one intermediate offset pivot.

2.3.3.4 Panic Device

Provide manufacturer's recommended standard panic hardware.

2.3.3.5 Closer

Provide surface closer only per ANSI/BHMA A156.4.

2.3.3.6 Security Lock/Dead Lock

Provide A/R MS 1850A lock with (2) A/R 1871 cylinder operated flush bolts.

2.3.3.7 Cylinder(s)/Thumb-turn

Provide manufacturer's recommended standard.

2.3.3.8 Cylinder Guard

Manufacturer standard.

2.4 RELATED MATERIALS

2.4.1 Sealants

Refer to Section 07 92 00 JOINT SEALANTS. Ensure all sealants conform to AAMA 800.

2.4.2 Glass

Refer to Section 08 81 00 GLAZING.

2.5 FABRICATION

2.5.1 Entrance System Fabrication

Provide door corner construction consisting of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Provide hook-in type exterior glazing stop with EPDM glazing gaskets reinforced with non-stretchable cord. Provide interior glazing stop mechanically fastened to the door member incorporating a silicone compatible spacer used with silicone sealant.

Accurately fit and secure joints and corners. Make joints hairline in appearance. Prepare components with internal reinforcement for door hardware. Arrange fasteners and attachments to conceal from view.

2.5.2 Shop Assembly

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

2.5.2.1 Welding

Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.5.3 Fabrication Tolerance

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances.

2.5.3.1 Material Cuts

Square to 1/32 inch off square, over largest dimension; proportionate amount of 1/32 inch on the two dimensions.

2.5.3.2 Maximum Offset

1/64 inch in alignment between two consecutive members in line, end to end.

2.5.3.3 Maximum Offset

1/64 inch between framing members at glazing pocket corners.

2.5.3.4 Joints

(Between adjacent members in same assembly: Hairline and square to adjacent member.

2.5.3.5 Variation

In squaring diagonals for doors and fabricated assemblies: 1/16 inch.

2.5.3.6 Flatness

For doors and fabricated assemblies: plus/minus 1/16 inch of neutral plane.

2.6 SOURCE QUALITY CONTROL

2.6.1 Source Quality

Provide aluminum entrances specified herein from a single source.

2.6.1.1 Building Enclosure System

When aluminum entrances are part of a building enclosure system, including storefront framing, windows, curtain wall system and related products, provide building enclosure system products from a single source manufacturer.

2.6.2 Fabrication Tolerances

Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Site Verification of Conditions

Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer's acceptable tolerances.

3.1.2 Field Measurements

Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.2 INSTALLATION

Install entrance system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten system to building structure. Align assembly

plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

Set thresholds in bed of mastic and secure. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylatron pads or bituminous coating. Shim and brace aluminum system before anchoring to structure. Verify weep holes are open, and metal joints are sealed in accordance with manufacturer's installation instructions. Seal metal to metal joints using sealant recommended by system manufacturer.

3.2.1 Preparation

Field verify dimensions prior to fabricating door portal assembly components.

Coordinate requirements for locations of blockouts for anchorage of door portal columns and other embedded components with Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

Coordinate erection of door portal with installation of surrounding glass wall and door assemblies. Ensure adequate provision is made for support and anchorage of assembly components.

Coordinate electrical requirements for electrified door hardware to ensure proper power source, conduit, wiring, and boxes.

3.2.1.1 Adjacent Surfaces Protection

Protect adjacent work areas and finish surfaces from damage during product installation.

3.2.1.2 Aluminum Surface Protection

Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.2.2 Adjusting

Adjust operating hardware for smooth operation, and as recommended by the manufacturer.

3.2.3 Related Products Installation Requirements

3.2.3.1 Sealants (Perimeter)

Refer to Section 07 92 00 JOINT SEALANTS.

3.2.3.2 Glass

Refer to Section 08 81 00 GLAZING.

3.2.3.3 Reference

ANSI Z97.1, 16 CFR 1201 and GANA Glazing Manual.

3.3 PROTECTION AND CLEANING

3.3.1 Protection

Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

3.3.2 Cleaning

Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.4 WARRANTY

Submit three signed copies of manufacturer's product warranty for entrance system as follows:

Warranty Period: Two years from Date of Substantial Completion of the project, provided that the Limited Warranty begins in no event later than six months from date of shipment by manufacturer. In addition, support welded door corner construction with a limited lifetime warranty for the life of the door under normal use.

Ensure Warranty language is identical to "As Approved" version of the sample warranty submitted and returned from the Contracting Officer.

-- End of Section --

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1302.5	(1976) Voluntary Specifications for Forced-Entry Resistant Aluminum Prime Windows
AAMA 1503	(2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
AAMA 611	(1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum
AAMA/WDMA/CSA 101/I.S.2/A440	(2008; Update 1 2008; Update 2 2008; Update 3 2009) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

ASTM INTERNATIONAL (ASTM)

ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM E 1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

GREEN SEAL (GS)

GS-36	(2000) Commercial Adhesives

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2010) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

1.2 CERTIFICATION

Each prime window unit must bear the AAMA Label warranting that the product complies with AAMA/WDMA/CSA 101/I.S.2/A440. Certified test reports attesting that the prime window units meet the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows;

Fabrication Drawings

SD-03 Product Data

Windows;

Hardware;

Fasteners;

Window performance;

Thermal-Barrier Windows;

Mullions;

SD-04 Samples

Finish Sample;

Window Sample;

SD-05 Design Data

Structural calculations for deflection;

Design Analysis;

Submit design analysis with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the minimum antiterrorism standards required by paragraph "Minimum Antiterrorism Performance", unless conformance is demonstrated by Standard Airblast Test results. Calculations verifying the structural performance of each window proposed for use, under the given loads, shall be prepared and signed by a registered Professional Engineer. The window components and anchorage devices to the structure, as determined by the design analysis, shall be reflected in the shop drawings.

SD-06 Test Reports

Minimum condensation resistance factor

Resistance to forced entry

Standard Airblast Test; G

For Minimum hurricane resistant windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shocktube, shall be included in a test report, providing information in accordance with ASTM F 1642, as prepared by the independent testing agency performing the test. The test results shall demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph "Standard Airblast Test Method".

SD-10 Operation and Maintenance Data

Windows.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, stools, casings, sills, trim, installation details, and other related items.

1.4.2 Sample Requirements

1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

1.4.2.2 Window Sample Requirements

Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

1.4.3 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements. A registered Professional Engineer must provide calculations.

Submit design analysis with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the requirements. Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

1.4.4 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, and minimum condensation resistance factor (CRF), and resistance to forced entry.

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which calking and glazing compounds must adhere.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.8 FIELD MEASUREMENTS

Take field measurements prior to preparation of the drawings and fabrication.

1.9 PERFORMANCE REQUIREMENTS

1.9.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least 50 pounds per square foot (psf).

1.9.2 Tests

Test windows proposed for use in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

1.10 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

1.11 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.11.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

1.11.2 Air Infiltration

Air infiltration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.3 Water Penetration

Water penetration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.4 Thermal Performance

Non-residential aluminum windows (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of 0.25 determined according to NFRC 200 procedures and a U-factor maximum of 0.65 Btu/hr-ft^2-F in accordance with NFRC 100.

1.12 QUALIFICATION

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 10 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.13 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

Provide prime windows that comply with AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. In addition to compliance with AAMA/WDMA/CSA 101/I.S.2/A440, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds L/175 of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 42 when tested in accordance with AAMA 1503.

2.1.1 Fixed Windows (F)

Type F-R15.

2.1.2 Forced Entry Resistant Windows

In addition to meeting the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, windows designated for resistance to forced entry must conform to the requirements of AAMA 1302.5.

2.1.3 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

2.1.4 Calking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

2.1.5 Weatherstripping

AAMA/WDMA/CSA 101/I.S.2/A440.

2.2 FABRICATION

Fabrication of window units must comply with AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown.

2.2.2 Weatherstripping

Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) compression-type weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do no use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.

2.2.3 Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

2.2.4 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials, GS-36, SCAQMD Rule 1168, and as specified in Section 07 92 00 JOINT SEALANTS.

2.2.5 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

2.2.6 Combination Windows

Windows used in combination must be the same class and grade and will be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.7 Mullions and Transom Bars

Provide mullions between multiple window units to resist two times (2X) glazing resistance in accordance with ASTM F 2248 and ASTM E 1300. Provide mullions with a thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

2.2.8 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete

installation and proper operation. Furnish extruded aluminum subframe receptors and subsill with each window unit.

2.2.8.1 Hardware

AAMA/WDMA/CSA 101/I.S.2/A440. The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.8.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

2.2.9 Finishes

Exposed aluminum surfaces must be factory finished with an anodic coating. Color must be clear. All windows will have the same finish.

2.2.9.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

b. Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A41, clear (natural) anodized.

2.3 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

a. Aluminum alloy must be 6063-T6.

b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors will not bridge the connection between the inner and outer frame.

2.4 MULLIONS

Provide mullions between multiple-window units where indicated.

Mullions and mullion covers must be the profile indicated, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or

pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members shall be fabricated of the materials specified in AAMA/WDMA/CSA 101/I.S.2/A440 and meet the specified design loading.

PART 3 TITLE

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to AAMA/WDMA/CSA 101/I.S.2/A440. Do not coat surfaces in contact with sealants after installation with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM F 883	(2009) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2006) Butts and Hinges
ANSI/BHMA A156.13	(2005) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.15	(2006) Release Devices Closer Holder, Electromagnetic and Electromechanical
ANSI/BHMA A156.16	(2008) Auxiliary Hardware
ANSI/BHMA A156.18	(2006) Materials and Finishes
ANSI/BHMA A156.21	(2009) Thresholds
ANSI/BHMA A156.22	(2005) Door Gasketing and Edge Seal Systems
ANSI/BHMA A156.3	(2008) Exit Devices
ANSI/BHMA A156.4	(2008) Door Controls - Closers
ANSI/BHMA A156.5	(2010) Auxiliary Locks and Associated Products
ANSI/BHMA A156.6	(2010) Architectural Door Trim
ANSI/BHMA A156.7	(2003; R 2009) Template Hinge Dimensions
ANSI/BHMA A156.8	(2010) Door Controls - Overhead Stops and Holders

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2012) Life Safety Code

NFPA 80 (2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2011) Building Materials Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hardware schedule;

Keying system;

SD-03 Product Data

Hardware items;

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule items,

Submit data package in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Key Bitting

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designation

1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys (AA1, AA2, etc.).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, pivots, and closers of one lock, hinge, pivot, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.5.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware subcontractor, using Activity and Base Locksmith shall meet to discuss key requirements for the facility.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Provide hardware to be applied to metal or to prefinished doors manufactured to template. Promptly furnish template information or templates to door and frame manufacturers. Conform to ANSI/BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements indicated, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Provide the label of Underwriters Laboratories, Inc. for such hardware listed in UL Bld Mat Dir or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the

identifying mark will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

ANSI/BHMA A156.1, 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

2.3.2 Pivots

ANSI/BHMA A156.4.

2.3.3 Locks and Latches

2.3.3.1 Mortise Locks and Latches

ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Install knobs and roses of mortise locks with screwless shanks and no exposed screws.

2.3.4 Exit Devices

ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide touch bars in lieu of conventional crossbars and arms. Provide escutcheons, not less than 7 by 2-1/4 inch.

2.3.5 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Provide cylinders and cores with seven pin tumblers. Provide cylinders from products of one manufacturer, and provide cores from the products of one manufacturer. Mortise cylinders have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core. Provide cylinders for new locks, including locks provided under other sections of this specification. Provide fully compatible cylinders with products of the Best Lock Corporation with interchangeable cores which are removable by a special control key. Factory set the cores with seven pin tumblers using the A4 system and F keyway. Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores.

2.3.6 Keying System

The Government will provide permanent cylinders with cores and keys for mortise locksets, auxiliary locks, and exit devices. Furnish cylinders as manufactured by Best Lock Corp., Arrow Lock Corp., or Falcon Lock. Coordinate delivery schedule with FLETC Lock and Key Department and the COR. Provide temporary cores and keys for the Contractor's use during construction, and for testing the locksets.

2.3.7 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.3.7.1 Lever Handles

Provide lever handles in lieu of knobs where indicated in paragraph entitled "Hardware Schedule". Conform to the minimum requirements of ANSI/BHMA A156.13 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

2.3.7.2 Texture

Provide knurled or abrasive coated knobs or lever handles where specified in paragraph entitled "Hardware Schedule".

2.3.8 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room number on keys.

Furnish seven change keys for each interchangeable core, furnish two control keys, six masters keys, and six construction master keys. Furnish a quantity of key blanks equal to 20 percent of the total number of change keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room numbers on keys.

2.3.9 Door Bolts

ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: ANSI/BHMA A156.3, Type 25.

2.3.10 Closers

ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, except at storefront mounting, pivots, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

2.3.10.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.3.11 Overhead Holders

ANSI/BHMA A156.8.

2.3.12 Closer Holder-Release Devices

ANSI/BHMA A156.15.

2.3.13 Door Protection Plates

ANSI/BHMA A156.6.

2.3.13.1 Sizes of Armor Mop and Kick Plates

2 inch less than door width for single doors; one inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors. Provide a minimum 36 inch armor plates for flush doors, except 16 inch high armor plates on fire doors.Provide 6 inch mop plates.

2.3.14 Door Stops and Silencers

ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.15 Padlocks

ASTM F 883.

2.3.16 Thresholds

ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.17 Weather Stripping Gasketing

ANSI/BHMA A156.22. Provide the type and function designation where specified in paragraph entitled "Hardware Schedule". Provide a set to include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors not to exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Provide weather stripping with one of the following:

2.3.17.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

2.3.17.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

2.3.17.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

2.3.18 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant and fasten with stainless steel screws.

2.3.18.1 Door Rain Drips

Approximately 1-1/2 inch high by 5/8 inch projection. Align bottom with bottom edge of door.

2.3.18.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

2.3.19 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Provide stainless steel or nonferrous metal fasteners that are exposed to weather. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISHES

ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint finish for surface door closers, and except BHMA 652 finish (satin chromium plated) for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

2.6 KEY CABINET AND CONTROL SYSTEM

ANSI/BHMA A156.5, Type E8351 (150 hooks).

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping to prevent damage. Provide full contact, weather-tight seals. Operate doors without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 9 inch on center after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door 1 inch on center and to heads and jambs at 4 inch on center

3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 1-1/2 inch on center.

3.1.2 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

3.3 HARDWARE LOCATIONS

SDI/DOOR A250.8, unless indicated or specified otherwise.

a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.

b. Mop Plates: Bottom flush with bottom of door.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct,

repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

Provide hardware for aluminum doors under this section. Deliver Hardware templates and hardware, except field-applied hardware to the aluminum door and frame manufacturer for use in fabricating the doors and frames.

Below are examples of some typical hardware sets. Each task order will identify hardware set requirements:

HW-1 (EXTERIOR ENTRY)

PIVOTS		--	BY DOOR MFG.
1 EXIT DEVICE	PANELINE, CONCEALED ROD	--	KAWNEER
1 PULL	12" PULL	--	BY DOOR MFG.
1 CYLINDERS	1E74-C4	612	BEST
1 CLOSER	CONCEALED, OVERHEAD	--	BY DOOR MFG.
1 THRESHOLD	2005AT	--	PEMKO
1 DOOR SWEEP	90137CNB	--	PEMKO
1 SET WEATHERSTRIPING		--	BY DOOR MFG.

HW-2 (EXTERIOR ENTRY - PAIR)

PIVOTS		--	BY DOOR MFG.
2 PULL	12" PULL	--	BY DOOR MFG.
1 CYLINDERS	1E74-C4	612	BEST
2 CLOSER	CONCEALED, OVERHEAD	--	BY DOOR MFG.
2 THRESHOLD	2005AT	--	PEMKO
2 DOOR SWEEP	90137CNB	--	PEMKO
2 SET WEATHERSTRIPING		--	BY DOOR MFG.
1 COMBINATION FLUSH BOLT SET		--	BY DOOR MFG.

HW-3 (CORRIDOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 CLOSER	351-O	626 SARGENT
1 STOP	409 OR 440	626 ROCKWOOD
3 SILENCERS	608	GRAY ROCKWOOD

HW-4 (ROOM 109 SERVICE COUNTER)

3 EACH DOUBLE ACTION HINGES	4-1/2 x 4-1/2	626 HAGAR
2 PUSH PLATES	12 INCH PUSH PLATE	626 ROCKWOOD
1 STOP	409 OR 440	626 ROCKWOOD
1 CYLINDER	1E74-C4	612 BEST

HW-5 (DRESSING ROOMS)

3 EACH HINGES	ECBB1101 4-1/2 BY 4-1/2	626 HAGAR
1 LOCKSET PRIVACY	45H7R14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 OR 440	626 ROCKWOOD

3 SILENCERS	608	GRAY ROCKWOOD

HW-6 (INTERIOR CONFERENCE ROOM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7R14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-7 (INTERIOR OFFICE)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7AT14J	626 BEST
1 COAT HOOK (off. side)	790	626 ROCKWOOD
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-8 (INTERIOR DOUBLE DOORS)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
2 CLOSERS	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD

HW-9 (EXTERIOR SECURE ELEC.)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD
1 HEAD DRIP		PEMKO
1 SET WEATHERSTRIPPING		PEMKO
1 DOOR SWEEP	90137CNB	PEMKO

CARD READER TO BE INSTALLED BY OTHERS

HW-10 (INTERIOR SECURE COMM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

CARD READER TO BE INSTALLED BY OTHERS

HW-11 (INTERIOR STORAGE)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-12 (MAILROOM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7D14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-13 (EGRESS DOOR - INTERIOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (EGRESS FUNCTION)	45H7D14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-14 (EXTERIOR PAIR)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (STORAGE)	45H7A14J	626 BEST
2 CLOSERS	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD
1 ASTREGAL		626
1 THRESHOLD	2005AT	PEMKO
2 DOOR SWEEP	90137CNB	PEMKO
2 SETS WEATHERSTRIPPING		PEMKO

HW-14A (EXTERIOR PAIR)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
2 EXIT DEVICE	PANELINE, CONCEALED ROD	US28 DOOR-O-MATIC
2 CLOSER	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD
1 ASTREGAL		626
1 THRESHOLD	2005AT	PEMKO
2 DOOR SWEEP	90137CNB	PEMKO
2 SETS WEATHERSTRIPPING		PEMKO

CARD READER TO BE INSTALLED BY OTHERS

HW-15 (EGRESS DOOR - EXTERIOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (EGRESS FUNCTION)	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD
1 HEAD DRIP		PEMKO
1 SET WEATHERSTRIPPING		PEMKO
1 DOOR SWEEP	90137CNB	PEMKO

1 THRESHOLD	2005AT	PEMKO	

HW-16 (TOILET & BREAK ROOMS)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626	HAGAR
1 SET PUSH /PULL	12 INCH PULL, PUSH PLATE	626	ROCKWOOD
1 STOP	409 or 440	626	ROCKWOOD
3 SILENCERS	608	Gray	ROCKWOOD

-- End of Section --

SECTION 08 81 00

GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2009; Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

ASTM INTERNATIONAL (ASTM)

ASTM C1036	(2011) Standard Specification for Flat Glass
ASTM C1048	(2004) Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM C1172	(2009e1) Standard Specification for Laminated Architectural Flat Glass
ASTM C1184	(2005) Standard Specification for Structural Silicone Sealants
ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C864	(2005; R 2011) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D2287	(2011) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D395	(2003; R 2008) Standard Test Methods for Rubber Property - Compression Set
ASTM E119	(2011a) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E2129	(2010) Standard Practice for Data Collection for Sustainability Assessment of Building Products

ASTM E413	(2010) Rating Sound Insulation
ASTM E90	(2009) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual
GANA Standards Manual	(2001) Tempering Division's Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-3001	(1990) Guidelines for Sloped Glazing
IGMA TM-3000	(1997) Glazing Guidelines for Sealed Insulating Glass Units
IGMA TR-1200	(1983) Commercial Insulating Glass Dimensional Tolerances

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2010) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

SD-03 Product Data

Insulating Glass

Documentation for Energy Star qualifications.

Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Samples

Insulating Glass;

Sealant;

Two 8 by 10 inch samples of each of the following: tinted glass, patterned glass, heat-absorbing glass, and insulating glass units.

Two samples of each indicated material. Samples of plastic sheets shall be minimum 5 by 7 inches.

SD-07 Certificates

Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

SD-08 Manufacturer's Instructions

Setting and sealing materials

Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

SD-11 Closeout Submittals

Insulated Glass Warranty

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in

accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E1300.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.7 WARRANTY

1.7.1 Warranty for Insulating Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

PART 2 PRODUCTS

2.1 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Clear Glass

For interior glazing (i.e., pass and observation windows), 1/4 inch thick glass should be used.

Type I, Class 1 (clear), Quality q4 (A). Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 1/8 inch float glass for openings up to and including 15 square feet, 3/16 inch for glazing openings over 15 square feet but not over 30 square feet, and 1/4 inch for glazing openings over 30 square feet but not over 45 square feet.

2.1.2 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - tinted, Quality q3 - glazing select, 40 percent light transmittance, .67 percent shading coefficient, conforming to ASTM C1036. Color shall be gray.

2.1.3 Laminated Glass

ASTM C1172, Kind LA fabricated from two nominal 1/8 inchpieces of Type I, Class 1, Quality q3, flat annealed transparent glass conforming to ASTM C1036. Flat glass shall be laminated together with a minimum of 0.030 inch thick, clear polyvinyl butyral interlayer. The total thickness shall be nominally 1/4 inch.

2.1.4 Mirrors

2.1.4.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.1.5 Tempered Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 2 (tinted heat absorbing), Quality q3, 1/4 inch thick, 40 percent light transmittance, .67 percent shading coefficient conforming to ASTM C1048 and GANA Standards Manual. Color shall be gray.

2.1.6 Fire/Safety Rated Glass

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass shall have a 45 minute rating when tested in accordance with ASTM E119. Glass shall be permanently labeled with appropriate markings.

2.2 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated 1/2 inch airspace, filled with argon gas, and hermetically sealed. Non-residential glazed systems (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of .35 determined according to NFRC 200 procedures and a U-factor maximum of .70 Btu/hr-ft2-F in accordance with NFRC 100. Glazing shall meet or exceed a luminous efficacy of 1.0.Glazed panels shall be rated for not less than 30 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

Two panes of glass separated by a dehydrated airspace and hermetically sealed. Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

2.2.1 Buildings

Two panes of glass separated by a dehydrated airspace, filled with argon gas and hermetically sealed.

Insulated glass units shall have a Solar Heat Gain Coefficient (SHGC) maximum of .35 and a U-factor maximum of .70 Btu per square foot by hr by degree F.

Glazing shall meet or exceed a luminous efficacy of 1.0. Glazed panels shall be rated for not less than 30 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

The inner light shall be ASTM C1172, clear annealed flat glass Type I, Class I, Quality q3, 1/4 inch thick. The outer light shall be ASTM C1172, Type I, Class 1, Quality q3, 1/8 inch thick, flat glass laminated together with 0.030 inch thick clear PVB interlayer, total thickness shall be 1/4 inch.

2.2.2 Low Emissivity Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 2-tinted with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C1036. Glass performance shall be U value maximum of .70 Btu/hr-ft2-F, Solar Heat Gain Coefficient (SHGC) maximum of.35. Color shall be gray.

2.3 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, IGMA TM-3000, IGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.

2.3.1 Putty and Glazing Compound

Glazing compound shall be as recommended by manufacturer for face-glazing metal sash. Putty shall be linseed oil type. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.3.2 Glazing Compound

Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

2.3.3 Sealants

Provide elastomeric and structural sealants.

2.3.3.1 Elastomeric Sealant

ASTM C920, Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units. Color of sealant shall be white.

2.3.3.2 Structural Sealant

ASTM C1184, Type S.

2.3.4 Joint Backer

Joint backer shall have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

2.3.5 Preformed Channels

Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.

2.3.6 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with ASTM D2287. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

2.3.7 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks shall be dense extruded type conforming to ASTM C509 and ASTM D395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (plus or minus 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer. Block color shall be black.

2.3.8 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.3.8.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C509, Type 2, Option 1.

2.3.8.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C864, Option 1, Shore A durometer between 65 and 75.

2.3.8.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.3.9 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

2.4 MIRROR ACCESSORIES

2.4.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.4.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 1-1/4 by 1/4 by 1/4 inch continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.4.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

PART 3 EXECUTION

3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work.Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.2.2 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of IGMA TB-3001 and IGMA TM-3000.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass.Upon removal, separate protective materials for reuse or recycling. Glass units which are broken, chipped,

cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

SECTION 08 91 00

METAL WALL LOUVERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2007) Laboratory Methods of Testing Dampers for Rating
AMCA 511	(2010) Certified Ratings Program for Air Control Devices

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611	(1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers;

SD-03 Product Data

Metal Wall Louvers;

SD-04 Samples

Wall louvers;

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.5 COLOR SAMPLES

Colors of finishes for wall louvers and door louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Galvanized Steel Sheet

ASTM A653/A653M, coating designation G90.

2.1.2 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

2.1.3 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

2.1.4 Cold Rolled Steel Sheet

ASTM A1008/A1008M, Class 1, with matte finish. Use for interior louvers only.

2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than 50 pounds per square foot. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. The rating shall

show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.

2.2.2 Formed Metal Louvers

Formed of zinc-coated steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 0.08 inch thick.

2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions where indicated for all louvers more than 5 feet in width at not more than 5 feet on centers. Provide mullions covers on both faces of joints between louvers.

2.2.4 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. For steel louvers, provide 1/2 inch square mesh, 12 or 16 gage zinc-coated steel; 1/2 inch square mesh, 16 gage copper; or 1/4 inch square mesh, 16 gage zinc-coated steel or copper bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be clear.

2.4.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish shall be:

a. Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A41, clear (natural) anodized.

2.4.2 Steel

Provide factory-applied coating. Clean and phosphate treat exposed surfaces and apply rust-inhibitive primer and baked enamel finish coat, one mil minimum total dry film thickness, color as selected.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Door Louvers

Install louvers in wood doors by using metal "Z" or "L" moldings. Fasten moldings to door with screws.

3.1.3 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.2 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

-- End of Section --

SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A463/A463M	(2010) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C645	(2011) Nonstructural Steel Framing Members
ASTM C754	(2011) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C841	(2003; R 2008e1) Installation of Interior Lathing and Furring
ASTM C847	(2010a) Standard Specification for Metal Lath

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM EMLA 920	(2009) Guide Specifications for Metal Lathing and Furring

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating. Provide support systems and attachments per UFC 3-310-04, "Seismic Design for Buildings" in seismic zones.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, and ASTM C847.

2.1.1.2 Non-loadbearing Wall Framing

NAAMM EMLA 920.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C645.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C645, but not thinner than 0.0179 inch thickness, with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork, equipment and fixtures, 0.0329 inch thickness. The ASTM certified third party testing statement for equivalent thicknesses shall not apply.

2.1.2.3 Furring Structural Steel Columns

ASTM C645. Steel (furring) clips and support angles listed in UL Fire Resistance may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

2.1.2.4 Z-Furring Channels with Wall Insulation

Not lighter than 26 gage galvanized steel, Z-shaped, with 1-1/4 inch and 3/4 inch flanges and depth as required by the insulation thickness provided.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Lath

3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, except as indicated otherwise.

3.1.1.2 Non-loadbearing Wall Framing

NAAMM EMLA 920, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C754, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2.2 Non-loadbearing Wall Framing and Furring

ASTM C754, except as indicated otherwise.

3.1.2.3 Furring Structural Steel Columns

Install studs or galvanized steel clips and support angles for erection of gypsum wallboard around structural steel columns in accordance with the UL Fire Resistance, design number(s) indicated.

3.1.2.4 Z-Furring Channels with Wall Insulation

Install Z-furring channels vertically spaced not more than 24 inches o.c. Locate Z-furring channels at interior and exterior corners in accordance with manufacturer's printed erection instructions. Fasten furring channels to masonry walls with powder-driven fasteners or hardened concrete steel nails through narrow flange of channel. Space fasteners not more than 24 inches o.c.

3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/4 inch in 8 feet from a straight line;

c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/8 inch in 8 feet from a straight line;

c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11	(1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM C1002	(2007) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C1047	(2010a) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
ASTM C1396/C1396M	(2011) Standard Specification for Gypsum Board
ASTM C475/C475M	(2002; R 2007) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C514	(2004; R 2009e1) Standard Specification for Nails for the Application of Gypsum Board
ASTM C840	(2008) Application and Finishing of Gypsum Board
ASTM C954	(2010) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

GYPSUM ASSOCIATION (GA)

GA 214	(2007) Recommended Levels of Gypsum Board Finish
GA 216	(2010) Application and Finishing of Gypsum Panel Products
GA 224	(2008) Installation of Predecorated Gypsum Board
GA 253	(2007) Application of Gypsum Sheathing
GA 600	(2009) Fire Resistance Design Manual

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cementitious backer units

Water-Resistant Gypsum Backing Board

Accessories

Submit for each type of gypsum board and for cementitious backer units.

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.4.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range. Gypsum wallboard shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.4.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Temperature

Maintain a uniform temperature of not less than 50 degrees F in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives.

1.5.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

1.5.3 Temporary Ventilation

Provide temporary ventilation for work of this section.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.7 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of 5 years of documented successful experience.

1.8 SCHEDULING

The gypsum wallboard shall be taped, spackled and primed before the installation of the highly-emitting materials.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.Submit Material Safety Data Sheets and manufacturer maintenance instructionsfor gypsum materials including adhesives.

2.1.1 Gypsum Board

ASTM C1396/C1396M. Gypsum board shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. Paper facings shall contain 100 percent post-consumer recycled paper content. Gypsum cores shall contain a minimum of 95 percent post-industrial recycled gypsum content.See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Gypsum board may contain post-consumer or post-industrial recycled content.

2.1.1.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.1.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2 Gypsum Backing Board

ASTM C1396/C1396M, gypsum backing board shall be used as a base in a multilayer system.

2.1.2.1 Regular

48 inch wide, 5/8 inch thick, square edges.

2.1.3 Regular Water-Resistant Gypsum Backing Board

ASTM C1396/C1396M

2.1.3.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.3.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.4 Cementitious Backer Units

In accordance with the Tile Council of America (TCA) Handbook.

2.1.5 Joint Treatment Materials

ASTM C475/C475M. Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds shall be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

2.1.5.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.5.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.5.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.5.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.5.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.6 Fasteners

2.1.6.1 Nails

ASTM C514.

2.1.6.2 Screws

ASTM C1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

2.1.6.3 Staples

No. 16 USS gageflattened galvanized wire staples with 7/16 inch wide crown outside measurement and divergent point for base ply of two-ply gypsum board application. Use as follows:

Length of Legs	Thickness of Gypsum Board
28.6 mm 1-1/8 inches	12.7 mm 1/2 inch
31.8 mm 1-1/4 inches	15.9 mm 5/8 inch

2.1.7 Adhesives

Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene. Adhesive must meet the requirements of LEED low emitting materials credit.

2.1.7.1 Adhesive for Fastening Gypsum Board to Metal Framing

Not permitted.

2.1.7.2 Adhesive for Laminating

Not permitted. Adhesive attachment is not permitted for multi-layer gypsum boards.

2.1.8 Gypsum Studs

Provide one inch minimum thickness and 6 inch minimum width. Studs may be of one inch thick gypsum board or multilayers fastened to required thickness. Conform to ASTM C1396/C1396M for material.

2.1.9 Accessories

ASTM C1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges shall be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.10 Asphalt Impregnated Building Felt

Provide a 15 lb asphalt moisture barrier over gypsum sheathing. Conforming to ASTM D 226/D 226M Type 1 (No. 15) for asphalt impregnated building felt.

2.1.11 Water

Provide clean, fresh, and potable water.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Gypsum Board and Framing

Verify that surfaces of gypsum board and framing to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.1.3 Masonry Walls

Verify that surfaces of masonry walls to receive gypsum board applied with adhesive are dry, free of dust, oil, form release agents, protrusions and

voids, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C840 or GA 216 and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may not be bonded together with an adhesive. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Minimize framing by floating corners with single studs and drywall clips. Install 5/8 inch gypsum or ceiling board over framing at 24 inches on center. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System I or GA 216.

3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System II or GA 216.

3.2.3 Adhesive Nail-On Application to Wood Framing

Apply in accordance with ASTM C840, System III or GA 216. This method may be used in lieu of ASTM C840, System I at the option of the Contractor.

3.2.4 Semi-Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System IV or GA 216.

3.2.5 Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System V or GA 216.

3.2.6 Adhesive Application to Interior Masonry or Concrete Walls

Apply in accordance with ASTM C840, System VI or GA 216.

3.2.7 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C840, System VIII or GA 216.

3.2.8 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C840, System IX or GA 216.

3.2.9 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply glass mat water-resistant gypsum tile backing board or water-resistant gypsum backing board in accordance with ASTM C840, System X or GA 216.

3.2.10 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with ASTM C840, System XI or GA 216.

3.2.11 Glass Mat Covered or Fiber Reinforced Gypsum Sheathing

Apply gypsum sheathing in accordance to gypsum association publications GA 253. Follow gypsum sheathing manufacturer's requirements of design details for joints and fasteners and be properly installed to protect the substrate from moisture intrusion. Do not leave exposed surfaces of the gypsum sheathing beyond the manufacturer's recommendation without a weather barrier cladding. Provide continuous asphalt impregnated building felt over sheathing surface in shingle fashion with edges and ends lapped a minimum of 6 inch. Property flash the openings. Seal all joints, seams, and penetrations with a compatible silicone sealant.

3.2.12 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C840, System XIII or GA 216. Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

3.2.13 Application of Foil-Backed Gypsum Board

Apply foil-backed gypsum board in accordance with ASTM C840, System XIV or GA 216.

3.2.14 Application of Predecorated Gypsum Board

Apply predecorated gypsum board in accordance with GA 224. Attach predecorated gypsum board with adhesive and fasteners as recommended by the manufacturer. Conceal fasteners in the finished work.

3.2.15 Application of Impact Resistant Gypsum Board

Apply in accordance with applicable system of ASTM C840 as specified or GA 216. Follow manufacturers written instructions on how to cut, drill and attach board.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with ANSI A108.11. Place a 15 lb asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 6 inch overlap of sheets laid shingle style.

3.3.2 Joint Treatment

ANSI A108.11.

3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Finish plenum areas above ceilings to Level 1 in accordance with GA 214. Finish water resistant gypsum backing board, ASTM C1396/C1396M, to receive ceramic tile to Level 2 in accordance with GA 214.Finish walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting to Level 3 in accordance with GA 214. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with GA 214.Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall framing in accordance with the specifications contained in UL Fire Resistance for the Design Number(s) indicated, or GA 600 for the File Number(s) indicated. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

-- End of Section --

SECTION 09 30 00

CERAMIC TILE, QUARRY TILE, AND PAVER TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1026	(2010) Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C1027	(2009) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C1028	(2007e1) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C144	(2011) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C206	(2003; R 2009) Standard Specification for Finishing Hydrated Lime
ASTM C207	(2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C241/C241M	(2009) Standard Specification for Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C33/C33M	(2011) Standard Specification for Concrete Aggregates
ASTM C373	(1988; R 2006) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C482	(2002; R 2009) Bond Strength of Ceramic Tile to Portland Cement
ASTM C501	(1984; R 2009) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser

ASTM C648	(2004; R 2009) Breaking Strength of Ceramic Tile
ASTM C847	(2010a) Standard Specification for Metal Lath
ASTM D 2103	(2010) Standard Specification for Polyethylene Film and Sheeting
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

GREEN SEAL (GS)

GS-36	(2000) Commercial Adhesives

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual	(2003) Dimension Stone Design Manual

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk	(2010) Handbook for Ceramic Tile Installation

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless

otherwise specifically authorized by manufacturer. For materials like Tile, Accessories, and marble Thresholds submit Samples of sufficient size to show color range, pattern, type and joints.

1.2.2 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Tile;
Setting-Bed;
Mortar, Grout, and Adhesive

SD-04 Samples

Tile;
Accessories;
Marble Thresholds;
Grout;

SD-06 Test Reports

Testing;

SD-07 Certificates

Tile;
Mortar, Grout, and Adhesive;

1.4 QUALITY ASSURANCE

Dimension and draw detail drawings at a minimum scale of 1/4 inch = 1 foot. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit drawings showing ceramic tile pattern elevations and floor plans.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 50 degrees F and rising. Maintain temperature above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.

1.8 EXTRA MATERIALS

Supply an extra five percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 TILE

Conform to TCA Hdbk for standard grade tile. Provide grade sealed containers. Mark seals with the marks on the signed master grade certificate. Provide an impact resistant tile with a minimum floor breaking strength for wall tile of 90 pound and for floor tile of 250 pound in accordance with ASTM C648. The manufacturer will provide a frost resistant rating for tile used in cold climate projects as determined by ASTM C1026. Provide a 0.50 maximum percent water absorption in accordance with ASTM C373. Provide a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C1028. Identify floor tile as Class IV Plus-Extra Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C1027 for abrasion resistance as related to foot traffic. Coordinate the color with Finish Specifications. Tile shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content, unless specified otherwise. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Tile may contain post-consumer or post-industrial recycled content. Submit manufacturer's catalog data and preprinted installation and cleaning instructions plus a master grade certificate for tile. Indicate VOC content.

2.1.1 Porcelain Tile

Furnish an unglazed porcelain tile and trim with the color extending uniformly through the body of the tile. Criteria for tile to meet or exceed is as follows: Abrasive wear in accordance with ASTM C501 and bonding strength in accordance with ASTM C482. Comply with 36 CFR 1191 for coefficient of friction for interior tiled floors. Coordinate color with Room Finish Specifications on drawings.

2.1.2 Glazed Wall Tile

Provide glazed wall tile with cushioned edges and trim edged with lead-free matte finish. Provide tile as noted on Finish Specification on drawings.

2.2 SETTING-BED

Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to ASTM C33/C33M for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to ASTM C150/C150M for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to ASTM C144 for sand.

2.2.4 Hydrated Lime

Conform to ASTM C206 for hydrated lime, Type S or ASTM C207, Type S.

2.2.5 Metal Lath

Conform to ASTM C847 for flat expanded type metal lath, and weighing a minimum 2.5 pound/square yard.

2.3 WATER

Provide potable water.

2.4 MORTAR, GROUT, AND ADHESIVE

Submit certificates indicating conformance with specified requirements. Submit LEED documentation relative to low-emitting materials credit in accordance with LEED Reference Guide. Include in LEED Documentation Notebook. Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of LEED low emitting materials credit. Conform to the following for mortar, grout, adhesive, and sealant:

2.4.1 Dry-Set Portland Cement Mortar

TCA Hdbk. Zero-volatile organic compound (VOC) content.

2.4.2 Ceramic Tile Grout

TCA Hdbk; petroleum-free and plastic-free sand portland cement grout. Maximum VOC content of 150 grams/liter.

2.4.3 Organic Adhesive

TCA Hdbk, Type I. Water-resistant. Comply with applicable regulations regarding toxic and hazardous materials, GS-36, and as specified. Tile adhesive shall have a maximum VOC content of 65 grams/liter.

2.4.4 Epoxy Resin Grout

TCA Hdbk. Prohibited unless specifically indicated otherwise.

2.4.5 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Single-component polyurethane sealant shall have a zero-VOC content.

2.4.6 Cementitious Backer Board

Provide cementitious backer units, for use as tile substrate over wood sub-floors, in accordance with TCA Hdbk. Furnish 1/2inch thick cementitious backer units.

2.5 MARBLE THRESHOLDS

Provide marble thresholds of size required by drawings or conditions. Categorize marble Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble with gray in color as approved by the Contracting Officer. Provide minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M.

2.6 MEMBRANE MATERIALS

Conform to ASTM D 226/D 226M, Type 1 for 15 pound waterproofing membrane, asphalt-saturated building felt. Conform to ASTM D 2103 4 mil for polyethylene film.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of TCA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.
Organic Adhesives	3 mm in 2.4 meter1/8 inch in 8 ft.	1.5 mm in 1 meter1/16 inch in 3 ft.
Latex Portland Cement Mortar	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.
Epoxy	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.

3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for

sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar.

3.3 INSTALLATION OF WALL TILE

Install wall tile in accordance with the TCA Hdbk.

3.3.1 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 4 mil polyethylene membrane, metal lath, and scratch coat. Conform to TCA Hdbk for workable mortar bed, materials, and installation of tile. Conform to TCA Hdbk for cured mortar bed and materials.

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use Latex-Portland Cement to install tile in accordance with TCA Hdbk. Use Latex Portland Cement when installing porcelain ceramic tile.

3.3.3 Organic Adhesive

Conform to TCA Hdbk for the organic adhesive installation of ceramic tile.

3.4 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with TCA Hdbk.

3.4.1 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to TCA Hdbk for workable mortar bed materials and installation. Conform to TCA Hdbk for cured mortar bed materials and installation. Provide minimum 1/4 inch to maximum 3/8 inch joints in uniformed width.

3.4.2 Dry-Set and Latex-Portland Cement

Use Latex-Portland cement mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with TCA Hdbk. Use Latex Portland cement when installing porcelain ceramic tile.

3.4.3 Resinous Grout

When resinous grout is indicated, grout quarry tile with epoxy resin grout. Rake and clean joints to the full depth of the tile and neutralize when recommended by the resin manufacturer. Install epoxy resin grout in conformance with TCA Hdbk. Install resin grout in accordance with manufacturer's printed installation instructions. Provide a coating of wax applied from the manufacturer on all tile installed and furan resin. Follow manufacturer's printed installation instructions of installed resin grout for proportioning, mixing, installing, and curing. Maintain the recommended temperature in the area and on the surface to be grouted. Protect finished grout of grout stain.

3.4.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCA Hdbk.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Install thresholds where indicated, in a manner similar to that of the ceramic tile floor. Provide thresholds full width of the opening. Install head joints at ends not exceeding 1/4 inch in width and grouted full.

3.6 EXPANSION JOINTS

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

3.6.1 Walls

Provide expansion joints at control joints in backing material. Wherever backing material changes, install an expansion joint to separate the different materials.

3.6.2 Floors

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Extend expansion joints through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles.

-- End of Section --

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A489	(2004e1) Standard Specification for Carbon Steel Lifting Eyes
ASTM A580/A580M	(2008) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2007) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635/C635M	(2007) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2010) Latex Sealants
ASTM E 1264	(2008e1) Acoustical Ceiling Products

ASTM E 1414	(2011) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E 1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
ASTM E 580/E 580M	(2011a) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 795	(2005) Mounting Test Specimens During Sound Absorption Tests

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2007; Change 1) Seismic Design for Buildings

1.2 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.2.1 Ceiling Attenuation Class and Test

Provide a ceiling system with an attenuation class (CAC) of 40 - 44 for ACT when determined in accordance with ASTM E 1414. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

1.2.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423 Test Method.

1.2.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings;

SD-03 Product Data

Acoustical Ceiling Systems;

SD-04 Samples

Acoustical Units;
Acoustic Ceiling Tiles;

SD-06 Test Reports

Fire Resistive Ceilings
Ceiling Attenuation Class and Test

1.4 NOT USED

1.5 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.7 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited

to, sagging and warping of panels; rusting and manufacturers defects of grid system.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Submit two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E 1264, Class A, and the following requirements:

2.1.1 Affirmative Procurement

Mineral Wool, Cellulose, and Laminated Paperboard used in acoustic ceiling tiles are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG). EPA's recommended Recovered Materials Content Levels for Mineral Wool, Cellulose, Structural Fiberboard and Laminated Paperboard are:

Product	Material	Percent of Post Consumer Materials	Percent of Total Recovered Materials
Laminate Paperboard	Post Consumer Paper	100	100
Rock Wool	Slag	75	
Cellulose	Post Consumer Paper	75	75

a. The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

2.1.2 Units for Exposed-Grid System A

a. Type: III (non-asbestos mineral fiber with painted finish).

b. Flame Spread: Class A, 25 or less

c. Pattern: A.

d. Minimum NRC: 0.75 in open office areas; 0.60 in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; 0.50 in all other rooms and areas when tested on mounting Type E-400 of ASTM E 795.

e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.

f. Nominal size: 24 by 24 inch.

g. Edge detail: Reveal.

h. Finish: Factory-applied standard finish.

i. Minimum CAC: 40.

2.1.3 Unit Acoustical Absorbers

Absorbers shall be individually mounted sound absorbing plaques composed of glass fibers or non-asbestos mineral fibers and having a NRC range of not less than 0.60 - 0.70 when tested in accordance with ASTM C423 and reported as a 4 frequency average.

2.2 SUSPENSION SYSTEM

Classification	kg/meter (lb/Linear Foot) of Main Runner		
	Direct Hung	Indirect Hung	Furring Bar
Light Duty	7.38 (5.0)	2.95 (2.0)	6.64 (4.5)
Intermediate Duty	17.72 (12.0)	5.17 (3.5)	9.6 (6.5)
Heavy Duty	23.62 (16.0)	11.81 (8.0)	-

Provide standard, exposed-grid, standard width flange as shown on drawings suspension system conforming to ASTM C635/C635M for heavy-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied white baked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide standard or mitered corners. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the guidance in UFC 3-310-04 and ASTM E 580/E 580M.

2.3 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.3.1 Wires

Conform wires to ASTM A641/A641M, Class 1, 0.11 inch in diameter. ASTM A580/A580M, composition 302 or 304, condition annealed stainless steel, 0.11 inch in diameter.

2.3.2 Straps

Provide straps of 1 by 3/16 inch galvanized steel conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008Mwith an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.3.3 Rods

Provide 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

2.3.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Eyebolt size must be a minimum 1/4 inch, zinc coated.

2.3.5 Masonry Anchorage Devices

Comply with ASTM C636/C636M for anchorage devices for eyebolts and machine screws.

2.4 ACCESS PANELS

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 12 by 12 inch or more than 12 by 24 inch.

a. Attach an identification plate of 0.032 inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.

b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 1 inch diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

1 Fire detection/alarm system

2 Air conditioning controls

3 Plumbing system

4 Heating and steam systems

5 Air conditioning duct system

6 Sprinkler system

7 Intercommunication system

11 Program entertainment

12 Telephone junction boxes

2.5 ADHESIVE

Use adhesive as recommended by tile manufacturer.

2.6 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.7 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components as noted on Room Finish Specifications.

2.8 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation.Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

3.4 RECLAMATION PROCEDURES

Neatly stack ceiling tile, designated for recycling by the Contracting Officer, on 4 by 4 foot pallets not higher than 4 foot. Panels must be completely dry. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4078	(2002; R 2008) Water Emulsion Floor Polish
ASTM E 648	(2010e1) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM F 1066	(2004e1; R 2010) Standard Specification for Vinyl Composition Floor Tile
ASTM F 1482	(2004; R 2009e1) Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
ASTM F 1861	(2008) Resilient Wall Base
ASTM F 1869	(2011) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F 2170	(2009) Determining Relative Humidity in Concrete Floor Slabs in situ Probes
ASTM F 710	(2011) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Fire Resistance Requirements

Provide a minimum average critical radiant flux of 0.22 watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E 648.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Flooring and Accessories;

SD-03 Product Data

Resilient Flooring and Accessories;
Adhesives;
Vinyl Composition Tile;
Wall Base;

SD-04 Samples

Resilient Flooring and Accessories;

SD-06 Test Reports

Moisture, Alkalinity and Bond Tests;

SD-08 Manufacturer's Instructions

Surface Preparation;
Installation;

SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories;

1.4 NOT USED

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature maintained

above 68 degrees F and below 85 degrees F, stacked according to manufacturer's recommendations. Remove resilient flooring products from packaging to allow ventilation prior to installation. Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store exposed rubber surface materials in occupied spaces. Do not store near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 68 degrees F and below 85 degrees F for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 55 degrees F thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.7 SCHEDULING

Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 VINYL COMPOSITION TILE TYPE A

Conform to ASTM F 1066 Class 2, (through pattern tile), Composition 1, asbestos-free, 12 inch square and 1/8 inch thick. Provide color and pattern uniformly distributed throughout the thickness of the tile. Tile shall contain a minimum of 90 percent recycled material.

2.2 WALL BASE

Conform to ASTM F 1861, Type TS (vulcanized thermoset rubber), Style B (coved - installed with resilient flooring). Provide 4 inch high and a minimum 1/8 inch thick wall base. Provide job formed corners in matching height, shape, and color. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Rubber sheet flooring may contain post-consumer or post-industrial recycled content.

2.3 MOULDING

Provide tapered mouldings of rubber and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide vertical lip on moulding of maximum 1/4 inch. Provide bevel change in level between 1/4 and 1/2 inch with a slope no greater than 1:2.

2.4 ADHESIVES

Provide adhesives for flooring, base and accessories as recommended by the manufacturer and comply with local indoor air quality standards. Interior adhesives shall meet the requirements of LEED low emitting materials credit. VOC content shall be less than 50 grams/L. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Provide Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

2.5 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers as recommended by the flooring manufacturer for the subfloor conditions. Comply with ASTM F 1482 for panel type underlayment products. Use one of the following substrates:

a. Concrete.

2.6 POLISH/FINISH

Provide polish finish as recommended by the manufacturer and conform to ASTM D 4078 for polish.

2.7 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

2.8 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories selected from manufacturer's standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers. Provide floor patterns as specified on the drawings. Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern. Submit scaled drawings indicating patterns (including location of patterns and colors) and dimensions. Submit manufacturer's descriptive data and three samples of each indicated color and type of flooring, base, mouldings, and accessories sized a minimum 2-1/2 by 4 inch. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 3 EXECUTION

3.1 EXAMINATION

Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation. Do not take any corrective action without written permission from the Government.Work will proceed only when conditions have been corrected and accepted by the installer. Submit manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

3.2 SURFACE PREPARATION

Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor to be flat to within 3/16 inch in 10 feet. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Prepare the surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) as recommended by the flooring manufacturer. Comply with ASTM F 710 for concrete subfloor preparation. Floor fills or toppings may be required as recommended by the flooring manufacturer. Install underlayments, when required by the flooring manufacturer, in accordance with manufacturer's recommended printed installation instructions. Comply with ASTM F 1482 for panel type underlayments. Before any work under this section is begun, correct all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces. Repair all damaged portions of concrete slabs as recommended by the flooring manufacturer. Remove concrete curing and sealer compounds from the slabs, other than the type that does not adversely affect adhesion. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.

3.3 MOISTURE, ALKALINITY AND BOND TESTS

Determine the suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing in accordance with ASTM F 1869 or ASTM F 2170, unless otherwise recommended by the flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Submit copy of test reports for moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

3.4 PLACING VINYL COMPOSITION, LINOLEUM AND SOLID VINYL TILES

Install tile flooring and accessories in accordance with manufacturer's printed installation instructions.Prepare and apply adhesives in accordance with manufacturer's directions. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

3.5 PLACING TRANSITION

Provide transition moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. Secure moulding with adhesive as recommended by the manufacturer. Prepare and apply adhesives in accordance with manufacturer's printed directions.

3.6 PLACING WALL BASE

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

3.7 CLEANING

Immediately upon completion of installation of flooring in a room or an area, dry/clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions. No sooner than 5 days after installation, wash flooring with a nonalkaline cleaning solution, rinse thoroughly with clear cold water, and, except for rubber flooring and stair treads, risers and stringers, vinyl and other flooring not requiring polish finish by manufacturer, apply the number of coats of polish in accordance with manufacturer's written instructions. Clean and maintain all other flooring as recommended by the manufacturer.

3.8 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

SECTION 09 68 00

CARPET

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC TM 107	(2009) Colorfastness to Water
AATCC TM 134	(2006; E 2008) Electrostatic Propensity of Carpets
AATCC TM 16	(2004; E 2008) Colorfastness to Light
AATCC TM 165	(2008; E 2009) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method
AATCC TM 174	(2007) Antimicrobial Activity Assessment of Carpets

ASTM INTERNATIONAL (ASTM)

ASTM D 3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D 5793	(2005) Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
ASTM D 5848	(2010e1) Mass Per Unit Area of Pile Yarn Floor Coverings
ASTM D 6859	(2005) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings
ASTM E 648	(2010e1) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2002) Standard for Installation Specification of Commercial Carpet

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1630	Standard for the Surface Flammability of Carpets and Rugs (FF 1-70)
40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Scheduling

Install carpet systems after the installation and ventilation period of materials or finishes which have high short-term emissions of VOCs, formaldehyde, particulates, or other air-borne compounds which may be adsorbed by or settle on the carpet tiles.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Carpet;
Moldings;
Surface Preparation;
Installation;

SD-04 Samples

Carpet;
Moldings;

SD-06 Test Reports

Moisture and Alkalinity Tests;

SD-10 Operation and Maintenance Data

Carpet;
Cleaning and Protection;
Maintenance Service

1.4 QUALITY ASSURANCE

Provide the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label for carpet and adhesives or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet, carpet cushion, and adhesives bearing the label will indicate that the carpet has been tested and meets the Regulatory Requirements and criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Procure carpet in accordance with 40 CFR 247, and where possible, purchased locally to reduce emissions of fossil fuels from transporting. Conform to EPA requirements in accordance RECYCLED / RECOVERED MATERIALS for carpet.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, and maintain at a temperature above 60 degrees F for 2 days prior to installation. Carpet or carpet tiles shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store carpet near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.6 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above 60 degrees F and below 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten (10) year wear warranty, two (2) year material and workmanship and ten (10) year tuft bind and delamination.

PART 2 PRODUCTS

2.1 CARPET

Furnish first quality carpet; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Provide the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) Label. Carpet type bearing the label will indicate that carpet has been tested and meets the criteria of the CRI Green Label Requirements for Indoor Air Quality Test Criteria. Provide carpet tiles with Carpet Component Identification Codes as established by the CRI for future recycling. The labels shall be permanently printed or attached to the carpet backing. The codes shall identify, at minimum, the carpet's

face fiber, primary backing, and secondary backing. Submit certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.
Submit Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's catalog data for the following items:
Carpet Moldings. Submit samples of the following:

a. Carpet: Two "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

b. Vinyl or Aluminum Moldings: Two pieces of each type at least 12 inches long.

c. Special Treatment Materials: Two samples showing system and installation method.

2.1.1 Modular Tile

Carpet shall comply with the following:

a. Carpet Construction: Tufted or Woven, see Finish Specifications on drawings.

b. Type: Modular tile, see Finish Specifications on drawings for sizes.

c. Pile Type: Multilevel loop.

d. Pile Fiber: Commercial 100 percent branded (federally registered trademark) nylon continuous filament.

e. Yarn Ply: Minimum 2.

f. Gauge or Pitch: Minimum 1/2 inch in accordance with ASTM D 5793.

g. Stitches or Rows/Wires: Minimum 8.0 per square inch.

h. Surface Pile Weight: Minimum 24 ounces per square yard. This does not include weight of backings. Determine weight in accordance with ASTM D 5848.

i. Pile Thickness: Minimum 0.120 inch in accordance with ASTM D 6859.

j. Pile Density: Minimum 4500.

k. Dye Method: Solution dyed.

l. Backing Materials: Provide primary backing materials like synthetic material. Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is needed. Carpet backing may contain post-consumer or post-industrial recycled content.

2.2 PERFORMANCE REQUIREMENTS

a. Static Control: Provide static control to permanently regulate static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC TM 134.

b. Flammability and Critical Radiant Flux Requirements: Comply carpet with 16 CFR 1630. Provide carpet in corridors and exits with a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648.

c. Tuft Bind: Provide tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 10 pound average force for loop pile.

d. Colorfastness to Crocking: Comply dry and wet crocking with AATCC TM 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

e. Colorfastness to Light: Comply colorfastness to light with AATCC TM 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

f. Colorfastness to Water: Comply colorfastness to water with AATCC TM 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

g. Delamination Strength: Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs/inch.

h. Antimicrobial: Nontoxic antimicrobial treatment in accordance with AATCC TM 174 Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.

2.3 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers shall comply with applicable regulations regarding toxic and hazardous materials. Use wet adhesive with a maximum VOC content of 50 grams/liter. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation to meet local air-quality standards, and as required by the carpet manufacturer. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 140 degrees F in accordance with ASTM D 3278.

2.4 MOLDINGS

Install carpet moldings, either vinyl or aluminum, where floor covering material changes or carpet edge does not abut a vertical surface. Provide a hammered surface aluminum molding, pinless clamp-down type, designed for the type of carpet being installed. Provide natural color anodized or heavy-duty vinyl molding designed for the type of carpet being installed.

2.5 TAPE

Provide tape for seams as recommended by the carpet manufacturer for the type of seam used in installation. Any seam sealant shall have a maximum

VOC content of 50 grams/liter. Do not use sealants that contain 1,1,1-trichloroethane or toluene.

2.6 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern in accordance with the drawings.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

3.2 MOISTURE AND ALKALINITY TESTS

Test concrete slab for moisture content and excessive alkalinity in accordance with CRI 104. Submit three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the carpeting until concrete substrate is at least 90 days old. Prepare the concrete surfaces in accordance with instructions of the carpet manufacturer. Match carpet, when required, and adhesives to prevent off-gassing to a type of curing compounds, leveling agents, and concrete sealer.

3.4 INSTALLATION

Isolate area of installation from rest of building. Perform all work by installers who are CFI certified (International Certified Floorcovering Installer Association), or manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI 104. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Use autofoam mothproofing system for wool carpets. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Submit three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

3.4.1 Modular Tile Installation

Install modular tiles with permanent vinyl-compatible or release adhesive and snugly jointed together. Lay tiles as noted on drawings with accessibility to the subfloor where required.

3.4.2 Entrance Carpet Installation

Install tiles with permanent vinyl-compatible or release adhesive and shall be snugly jointed together. Lay tiles as shown on drawings.Prepare regular, unnoticeable, and treated seams with a seam adhesive. Install breadths parallel, with carpet pile in the same direction. Match patterns accurately. Neatly cut and fit, securely, cutouts at door jambs, columns, and ducts. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points.

3.5 CLEANING AND PROTECTION

Submit three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

3.5.1 Cleaning

As specified in Section 01 78 00 CLOSEOUT SUBMITTALS. After installation of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean with a high-efficiency particulate air (HEPA) filtration vacuum.

3.5.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover.Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer. Installation of carpet shall occur when all other trades have completed their work just before substantial completion.

3.6 REMNANTS

Remove non-retained scraps from site and recycle appropriately.

-- End of Section --

SECTION 09 72 00

WALL COVERINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 751	(2006) Coated Fabrics
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)

CFFA-W-101-D	(2002) Vinyl Coated Fabric Wallcovering

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

GYPSUM ASSOCIATION (GA)

GA 214	(2007) Recommended Levels of Gypsum Board Finish

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 286	(2011) Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS CCC-W-408	(Rev D; Notice 1) Wallcovering, Vinyl Coated

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wall Coverings and Accessories;
Primer and Adhesive;
Vinyl Wall Covering;

SD-04 Samples

Wall Coverings and Accessories;
Wall Coverings;

SD-08 Manufacturer's Instructions

Wall Coverings and Accessories

SD-10 Operation and Maintenance Data

Vinyl Wall Covering;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver the material to the site in manufacturer's original wrappings and packages and clearly label with the manufacturer's name, brand name, pattern and color name and number, dye lot number, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than 50 degrees F and within a relative humidity range of 30 to 60 percent. Store wall covering material in a flat position and protected from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

1.5 ENVIRONMENTAL REQUIREMENTS

Comply with wall covering manufacturer's printed installation instructions for minimum temperature of area to receive requirements for conditioning adhesive and wall covering. Provide a minimum 50 degrees F area temperature, 72 hours prior to installation, during installation, and until the adhesive dries. Observe ventilation and safety procedures.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period.

PART 2 PRODUCTS

2.1 WALL COVERINGS

Provide Wall coverings and accessories material designed specifically for the specified use. Furnish vinyl wall covering and borders with a mercury, cadmium, lead, and chromium free base. Protect wall coverings with

bactericides and mildew inhibitors against microbiological and mildew growth.

2.1.1 Vinyl Wall Covering

Provide vinyl wall covering with an integrally pigmented, opaque vinyl film, laminated to, or combined with, a fabric backing and submit manufacturer's catalog data. For wall coverings in general, vinyl wall covering, accessories, primer and adhesive submit/provide the following, as applicable:

a. Wall covering manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

b. Primer and Adhesive manufacturer's descriptive data, documentation stating physical characteristics, mildew and germicidal characteristics. Also Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

c. Three samples of each indicated type, pattern, and color of wall covering. Provide minimum 5 by 7 inch samples of wall covering to show pattern repeat of sufficient size.

d. Vinyl Wall Covering Mockup Panels. After vinyl wall covering samples are approved, and prior to starting installation, provide a minimum 8 by 8 foot vinyl wall covering mock-up for each color and type of vinyl wall covering, using the proposed primers and adhesives and actual substrate materials. Once approved, use the mock-up samples as a standard of workmanship for installation within the facility. Written notification to the Contracting Officer at least 48 hours prior to mock-up installation.

e. Wall Covering: Three samples, 3 yards long by the width specified, of each color and grain to be installed in the work, as required to illustrate material weight, color, shade, decorative design, and embossing when required.

f. Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. Date the statement after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified. Certificates for Vinyl Wall Covering including the following:

   (1) Certified laboratory test reports of the physical properties for vinyl wall covering, as specified.

   (2) Certificates of Compliance for UL fire hazard classification listing, as specified.

   (3) Certificates of Compliance for contact adhesive.

g. Preprinted installation instructions for wall covering and accessories, adhesives and primers. Include preparation of the substrate within the instructions.

h. Preventative maintenance and inspection for Vinyl Wall Covering showing the manufacturer's recommended cleaning materials and application methods, including precautions in the use of cleaning materials that may be detrimental to the wall covering surface when improperly applied.

Provide a medium-duty type wall covering, finish as specified, conforming to FS CCC-W-408, Type II, and the following modifications:

Supporting material for wall covering may be mildew-resistant treated at the option of the wall covering manufacturer.

Provide the following physical properties:

REQUIREMENT	TEST METHOD	VALUE
Coating weight, exclusive of fabric backing	CFFA-W-101-D, Test 5041	Not less than 240 gm per square meter 7 ounces per square yard
Adhesion of coating to fabric backing	ASTM D 751	Not less that 13 N 3 pounds pull per 25 mm inch of width

Match color and grain of wall covering of the sample approved. Provide a 53 to 54 inch width wall covering.

2.1.2 Vinyl Wall covering Type A

	Type I	Type II	Type III
ozs/sq yd	7 (10)	13	
ozs/linear yd	10.5 (15)	20	
g/sq meter	237 (339)	441	
g/linear meter	325 (465)	620	

Provide a vinyl coated woven or nonwoven wall covering fabric. Conform to CFFA-W-101-D for vinyl wall covering, Type II (Medium Duty) with a minimum total weight of 13 ounces/square yard and 20 ounces/linear yard. Provide width of 52/54 inch. Test vinyl wall covering in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E 84.

2.2 PRIMER AND ADHESIVE

Provide a type primer and adhesive recommended by the wall covering manufacturer, containing a non-mercury based mildewcide, and complying with local indoor air quality standards. VOC content shall be less than the current VOC content limits of SCAQMD Rule 1168. Primer shall permit removal of the wall covering and protect the wall surface during removal. Do not damage gypsum wallboard facing paper during removal of wall covering. Provide a strippable type adhesive. When substrate color variations show through vinyl wall covering, provide a white pigmented primer as recommended

by the wall covering manufacturer used to conceal the variations. Provide a recommended type adhesive to install corner guards and wainscot cap by the manufacturer of the corner guards and wainscot cap.

2.3 COLOR, TEXTURE, AND PATTERN

Provide color as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 EXAMINATION

Inspect all areas and conditions under which wall coverings are to be installed. Notify the Contracting Officer, in writing, of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Do not apply wall covering to surfaces that are rough, that contain stains which will bleed through the wall covering, or that are otherwise unsuitable for proper installation. Fill cracks and holes; sand rough spots smooth. Finish walls to receive presentation dry erase wall covering to a Level 4 gypsum wallboard finish in accordance with GA 214 unless Level 5 is recommended by the wall covering manufacturer. Thoroughly dry surfaces at least 30 days prior to installation of vinyl wall covering. Provide interior surfaces of new and existing gypsum wallboard with a wall covering primer in accordance with the manufacturer's printed instructions. As required, use white primer when substrate color variations are visible through thin or light color wall covering. Seal interior surfaces of exterior masonry walls to prevent moisture penetration, then prime with a wall covering primer in accordance with the manufacturer's printed instructions. Provide masonry walls with flush joints. Test moisture content of plaster, concrete, and masonry with an electric moisture meter of a maximum five percent reading. Apply a thin coat of joint compound or cement plaster, as recommended by the wall covering manufacturer, to the concrete and masonry walls as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, prime the walls as recommended by the wall lining manufacturer. Prime the surfaces of walls as required by the manufacturer's printed instructions to permit ultimate removal of wall covering from the wall surfaces. Allow primer to completely dry before adhesive application.

3.3 INSTALLATION

3.3.1 Corner Guards and Wainscot Cap

Install corner guards and wainscot cap where shown on drawings and in accordance with the manufacturer's printed instructions. Run corner guards from top of base to ceiling in a continuous length.

3.4 CLEAN-UP

Upon completion of the work, clean wall covering free of dirt, soiling, stain, or residual film. Remove and clean surplus materials, rubbish, and debris resulting from the wall covering installation.

-- End of Section --

SECTION 09 83 13

ACOUSTICAL WALL TREATMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2009; Errata First Printing) International Building Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings;

SD-03 Product Data

Installation Acoustical Wall Panels;

SD-04 Samples

Acoustical Wall Panels;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Protect materials delivered and placed in storage from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 ACOUSTICAL WALL PANELS

Provide acoustical wall panels consisting of prefinished, factory assembled, seamless fabric covered, fiber glass or mineral fiber core system as described below manufactured to the dimensions and configurations shown on the approved detail drawings; submit drawings showing plan locations, elevations and details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials. Perimeter edges shall be reinforced by either an aluminum frame or a formulated resin edge hardener. Acoustical wall panels installed in non-sprinklered areas shall comply with the requirements of ICC IBC, Standard 42-2. Comply with EPA requirements in accordance with RECYCLED / RECOVERED MATERIALS. Submit manufacturer's descriptive data and catalog cuts; wood system with backing, minimum 18 inches wide by 24 inches long 3 samples of each color range specified; and certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance. Wall panels shall conform to the following:

a. Panel Width: Widths shall be nominal 48 inches Panel width shall be as detailed.

b. Panel Height: Heights shall be nominal 24 inches. Panels shall be field measured for custom fit to ceiling.

c. Thickness: Panel thickness shall be as required to meet the indicated NRC range; 3 and 1/8 inch.

d. Panel Construction: Seamless clear lacquer solid bentwood birch profiles, a lacquered solid wood frame and an acoustically rated polyester fiber batting with an anthracite-colored linen cover. Fabric covering shall be stretched free of wrinkles and then bonded to the edges and back or bonded directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer.

e. Fire rating for the complete composite system: Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E 84.

f. Noise Reduction Coefficient (NRC) Range: 0.80-0.90 ASTM C423.

g. Core Type: Acoustically rated polyester finer batting core.

h. Mounting: Acoustical panels shall be mounted by manufacturer's standard keyholes. Provide blocking in wall at all keyhole mounting sites. Install panels per manufacturer instructions. Coordinate keyhole locations to mount directly to studs. Panels to be installed horizontally.

2.2 COLOR

Color shall be as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Walls shall be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Do not begin installation until all wet work, such as, plastering, painting, and concrete are completely dry.

3.2 INSTALLATION

Panel installation shall be by personnel familiar with and normally engaged in installation of acoustical wall panels. Apply panels in accordance with the manufacturer's installation instructions. Submit manufacturer's installation instructions and recommended cleaning instructions.

3.3 CLEANING

Following installation, dirty or stained panel surfaces shall be cleaned in accordance with manufacturer's instructions and left free from defects. Panels that are damaged, discolored, or improperly installed shall be removed and new panels provided as directed.

-- End of Section --

SECTION 09 84 39

ACOUSTICAL CEILING CLOUDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

Other related sections include Section 09 51 00 ACOUSTICAL CEILINGS, Section 09 29 00 GYPSUM BOARD, Division 23 HVAC and Division 26 ELECTRICAL.

1.2 SUMMARY

This section includes acoustical clouds, attachment hangers and fasteners.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(2009c) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2010) Standard for the Installation of Sprinkler Systems

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

Layout and details of acoustical clouds. Show locations of items which are to be coordinated with acoustical clouds.

SD-03 Product Data

Acoustical Cloud Unit;

Submit manufacturer's technical data for each type of cloud system required.

SD-08 Manufacturer's Instructions

Installation instructions;

1.5 QUALITY ASSURANCE

1.5.1 Single Source Responsibility

Provide acoustical clouds and method of attachment by a single manufacturer.

1.5.2 Coordination of Work

Coordinate acoustical cloud work with installers of related work including, but not limited to suspended ceilings, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.5.3 Seismic Performance

The International Building Code allows architectural components to swing freely as long as they will not be damaged or cause damage. Soundscapes Shapes Acoustical Clouds suspended individually with aircraft cable will swing no more than 18 inches in any direction for each panel. Shapes direct attached to drywall or suspended in group systems have been engineered for application in all seismic areas.

1.5.4 Acoustical Clouds

Acoustical clouds, as with other architectural features located in the ceiling plane, may obstruct or skew the existing or planned fire sprinkler water distribution pattern, or possibly delay the activation of the fire sprinkler or fire detection system. Designers and installers are advised to consult a fire protection engineer, NFPA 13, and their local codes for guidance on the proper installation techniques where fire detection or suppression systems are present.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver acoustical clouds to project site in original, unopened packages and store them in a fully enclosed space between 40 degrees F and 120 degrees F where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes. All wet work (plastering, concrete, etc) must be complete and dry. Before installing acoustical clouds, permit them to reach room temperature and a stabilized moisture content. Handle acoustical clouds carefully to avoid damaging the surface and edges in any way.

1.7 PROJECT CONDITIONS

1.7.1 Space Enclosure

Building areas to receive acoustical clouds shall be free of construction dust and debris. Products can be installed in temperatures between 40

degrees F and 120 degrees F. Cannot be used in exterior applications, where standing water is present, or where moisture will come in direct contact with the acoustical cloud.

1.8 WARRANTY

1.8.1 Acoustical Clouds

Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical clouds that fail within the warranty period. Failures include, but are not limited to:

a. Acoustical clouds: Manufacturing defects or chipped or broken tiles.

b. Attachment devices: Rusting and manufacturing defects.

1.8.2 Warranty Period

Warranty Period shall be as follows:

a. Acoustical Clouds: One (1) year from date of substantial completion.

b. Attachment devices: One (1) year from date of substantial completion.

The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.1 ACOUSTICAL CLOUD UNITS

a. Surface Texture: See specifications on drawings.

b. Composition: See specifications on drawings.

c. Surface finish: See specifications on drawings.

d. Color: White

e. Shapes: Circle, see specifications on drawings and reflected ceiling plan.

f. Thickness: 7/8 inch

g. Flame Spread: ASTM E 84, Class A

h. Light Reflectance: (LR): ASTM E 1477, White: 0.90

i. Acoustical Absorption: ASTM C 423, White: Minimum 1.17 Sabins/sf

j. Recycle Content: Minimum 35 percent

k. Antimicrobial protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

2.2 ATTACHMENT SYSTEMS

Installation Hardware Kits for (individual suspension).

a. Deck Hanging Kit

b. Extended Hanging Cables

PART 3 EXECUTION

3.1 PREPARATION

Measure each ceiling area and establish layout of acoustical clouds and installation hardware. Comply with reflected ceiling plans. Coordinate panel layout with mechanical, electrical and sprinkler fixtures.

3.2 INSTALLATION

Install panels in accordance with the manufacturer's installation instructions, LA-297302, and in compliance with the authorities having jurisdiction.

3.3 ADJUSTING AND CLEANING

Replace damaged and broken tiles. Clean exposed surfaces of acoustical clouds per manufacturer's instructions.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100Doc	(2005) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 235	(2002; R 2007) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4263	(1983; R 2005) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4444	(2008) Use and Calibration of Hand-Held Moisture Meters
ASTM D 523	(2008) Standard Test Method for Specular Gloss
ASTM D 6386	(2010) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM F 1869	(2011) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

MASTER PAINTERS INSTITUTE (MPI)

MPI 107	(Oct 2009) Rust Inhibitive Primer (Water-Based)

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP-01	(2000) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Guide 6	(2004) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC Guide 7	(2004; E 2004) Guide to the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel
SSPC PA Guide 3	(1982; E 1995) A Guide to Safety in Paint Application
SSPC QP 1	(1998; E 2004) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
SSPC SP 1	(1982; E 2004) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP 12/NACE No.5	(2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SSPC SP 2	(1982; E 2004) Hand Tool Cleaning
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC VIS 1	(2002; e 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-680	(2010; Rev C) Degreasing Solvent

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(Rev D; Am 1) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1001	Asbestos
29 CFR 1910.1025	Lead
29 CFR 1926.62	Lead

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

SD-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Certification

Environmental Data

Materials;

Coating;

Manufacturer's Technical Data Sheets;

Indicate VOC content.

Sealant

SD-04 Samples

Color;

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

Qualification Testing laboratory for coatings;

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings:

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.3.2 SSPC QP 1 Certification

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4 NOT USED

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.4 Asbestos Content

Materials shall not contain asbestos.

1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.5.7 Human Carcinogens

Materials shall not contain ACGIH 0100Doc and ACGIH 0100Doc confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN.

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA Guide 3.

1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.

b. 29 CFR 1910.1000.

c. ACGIH 0100Doc, threshold limit values.

d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

e. The appropriate OSHA standards in 29 CFR 1910.1001 for surface preparation of painted surfaces containing asbestos. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

1.8 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. Isolate area of application from rest of building when applying high-emission paints or coatings.

1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Less than 5 degrees F above dew point;

b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.8.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.9 NOT USED

1.10 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs.

1.11 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be as indicated in the Finish Schedule specifications on drawings.

1.12 LOCATION AND SURFACE TYPE TO BE PAINTED

1.12.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.12.1.1 Exterior Painting

Includes new surfaces, existing coated surfaces, of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.12.1.2 Interior Painting

Includes new surfaces, existing uncoated surfaces, and existing coated surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.12.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

1.12.3 Mechanical and Electrical Painting

Includes field coating of interior new and existing surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation

(2) New aluminum jacket on piping

(3) New interior ferrous piping under insulation.

1.12.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material. In lieu of red enamel finish coat, provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals.

b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a

minimum dry film thickness of 1.0 mil. Provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals throughout the piping systems.

1.12.4 Definitions and Abbreviations

1.12.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.12.4.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

1.12.4.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.12.4.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.12.4.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.12.4.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.12.4.7 EXT

MPI short term designation for an exterior coating system.

1.12.4.8 INT

MPI short term designation for an interior coating system.

1.12.4.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.12.4.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.12.4.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.12.4.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.12.4.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.12.4.14 Paint

See Coating definition.

1.12.4.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.12.4.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 RESEALING OF EXISTING EXTERIOR JOINTS

3.2.1 Surface Condition

Surfaces shall be clean, dry to the touch, and free from frost and moisture; remove grease, oil, wax, lacquer, paint, defective backstop, or other foreign matter that would prevent or impair adhesion. Where adequate grooves have not been provided, clean out to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to adjoining work. Grinding shall not be required on metal surfaces.

3.2.2 Backstops

In joints more than 1/2 inch deep, install glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free of oil or other staining elements as recommended by sealant manufacturer. Backstop material shall be compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

3.2.3 Primer and Bond Breaker

Install the type recommended by the sealant manufacturer.

3.2.4 Ambient Temperature

Between 38 degrees F and 95 degrees F when applying sealant.

3.2.5 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Color(s) shall be selected by the Contracting Officer. Apply the sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Sealant shall be uniformly smooth and free of wrinkles.

3.2.6 Cleaning

Immediately remove fresh sealant from adjacent areas using a solvent recommended by the sealant manufacturer. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean condition. Allow sealant time to cure, in accordance with manufacturer's recommendations, prior to coating.

3.3 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.

b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D 235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.

c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.

d. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer.

e. Previously painted surfaces specified to be repainted or damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.

f. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.

g. Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8.

h. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.

i. Edges of chipped paint shall be feather edged and sanded smooth.

j. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.

k. New, proposed coatings shall be compatible with existing coatings.

3.3.2 Existing Coated Surfaces with Minor Defects

Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings. Remove chalking by sanding so that when tested in accordance with ASTM D 4214, the chalk rating is not less than 8.

3.3.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

a. Surfaces containing large areas of minor defects;

b. Surfaces containing more than 20 percent peeling area; and

c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

3.3.4 Substrate Repair

a. Repair substrate surface damaged during coating removal;

b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and

c. Clean and prime the substrate as specified.

3.4 PREPARATION OF METAL SURFACES

3.4.1 Existing and New Ferrous Surfaces

Ferrous Surface Preparation
SSPC Blasting/Cleaning Levelsa - Primer Types/Exposures

	Exposureb		
	Mild	Moderate	Severec
Primer Type	alkyd/oil latex oleoresinous phenolic	alkyd/oil latex oleoresinous phenolic	epoxy silicone inorganic zinc-rich
Surface Condition			
Uncoated			
Oil, grease, dirt	SP 1	for all moderate conditions, select from "mild" or "severe" for intended performance level	SP 10, SP 12 WJ2 or SP 5, SP 12 WJ1
Localized corrosion - mill scale, rust	SP 2, SP 3, or SP 7, SP 12 WJ-4		AS ABOVE
Extensive deterioration	SP 6d, SP 12 WJ-3		AS ABOVE
Shop coated			
Oil, grease, dirt	e		AS ABOVE
Localized damange to be spot repaired	SP 2, SP 3, or SP 7, SP 12 WJ-4		AS ABOVE
Extensive deterioration	SP 6d, SP 12 WJ-3		AS ABOVE

Existing coating			
Oil, grease	e	e	SP 1
Chalking, foreign matter other than oil or greese, localized deterioration	f		g
Extensive deterioration	SP 6d, SP 12 WJ-3		SP 10, SP 12 WJ2 or SP 5, SP 12 WJ1

a If it is not possible to abrasive blast or use water jetting, SP 11 is recommended. It is considered equivalent to SP 6. SP 11 is also preferred wherever SP 2 or SP 3 are shown in the Table.

b These are minimum requirements. A high-performing system may be a better choice forlonger performance.

c For marine, chemical, or immersion service, or application of heat resistant or nonslip floor coatings. SP 10 is preferred for zinc-rich primers, and for extremely severe environments where long-term performance is desired.

d Use water jetting to SP 12 WJ-3, as alternate to SP 6 degree ofcleanliness.

e Use only the steam clean, or non-alkaline detergent solutions of SP 1.

f First, remove chalk and dirt with a non-alkaline detergent solution, and follow with power wash at minimum 2000 psi. Second, spot clean, in order of preference by SP 6, SP 11, SP 7, SP 3, or SP2.

g First, remove chalk and dirt with a non-alkaline detergent solution, and follow with power wash at minimum 2000 psi. Second, spot clean, in order of preference, by SP 10, SP 6, or SP 11.

h SSPC SP 12/NACE No.5 provides four levels of water jetting cleanliness and they reflect thefour levels of abrasive blast cleanliness but direct correlation is inaccurate or inappropriate. Thefour levels are (best to worst): WJ-1, WJ-2, WJ-3, and WJ-4. They are equivalent to the abrasive blast standards SSPC SP 5, SP 10, SP 6, and SP 7. The standard also includes three levels of cleanliness for nonvisual contaminants, SC-1, SC-2, and SC-3. The preferred level of cleanliness is between SC-1or SC-2.

a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2. Brush-off blast remaining surface in accordance with SSPC SP 7/NACE No.4; Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/NACE No.3/SSPC SP 12/NACE No.5 WJ-3.

3.4.2 Final Ferrous Surface Condition:

Type Coating	Level of Cleaning, SSPC SP ...
a. Latex or Alkyd	2,3,6 or SP 12 WJ-2. (7 and 10, SP 12 WJ-2 or SP 12 WJ-1 may be left in as Contractor options)
b. High Performance (i.e. Epoxy, Urethane, others)	7,10

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

3.4.3 Galvanized Surfaces

a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 6386, Appendix X2, and remove by one of the methods described therein.

b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12/NACE No.5 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Spot abrasive blast rusted areas as described for steel in SSPC SP 6/NACE No.3, and waterjet to SSPC SP 12/NACE No.5, WJ3 to remove existing coating.

3.4.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.4.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D 235. Wipe dry with clean, dry cloths.

3.4.6 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water.

3.5 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.5.1 Concrete and Masonry

a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.

b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil:Wash new and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. Wash existing coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new , existing coated, and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.

c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet

in 24 hours as determined by ASTM F 1869. In all cases follow manufacturer's recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.5.2 Gypsum Board, Plaster, and Stucco

a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.

b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5.3 Existing Asbestos Cement Surfaces

Remove oily stains by solvent cleaning with mineral spirits, MIL-PRF-680. Remove loose dirt, dust, and other deleterious substances by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material. Do not wire brush or clean using other abrasive methods. Surfaces shall be dry and clean prior to application of the coating.

3.6 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.6.1 New Plywood and Wood Surfaces, Except Floors:

a. Wood surfaces shall be cleaned of foreign matter.

Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.

b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, 1 ounce (1/3 cup) household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

c. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D 4444, Method A, unless otherwise authorized.

d. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.

e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.

f. Cosmetic Repair of Minor Defects:

(1) Knots and Resinous Wood and Fire, Smoke, Water, and Color Marker Stained Existing Coated Surface: Prior to application of coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

3.7 APPLICATION

3.7.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while

painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 1.0 mil. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

e. Floors: For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.

3.7.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.7.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.7.4 Coating Systems

a. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.

b. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

c. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

   (1) One coat of primer.

   (2) One coat of undercoat or intermediate coat.

   (3) One topcoat to match adjacent surfaces.

d. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.8 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.9 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

3.10 COATING SYSTEMS FOR WOOD AND PLYWOOD

a. Apply coatings of Tables in Division 6 for Exterior and Interior.

b. Prior to erection, apply two coats of specified primer to treat and prime wood and plywood surfaces which will be inaccessible after erection.

c. Apply stains in accordance with manufacturer's printed instructions.

3.11 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with ASME A13.1. Place stenciling in clearly visible locations. On piping not covered by ASME A13.1, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.12 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.13 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers.

-- End of Section --

SECTION 10 14 02

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2004) Safety Glazing Materials Used in Buildings

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Installation;

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Samples

Interior Signage;

One sample of each of the following sign types showing typical quality, workmanship and color. The samples may be installed in the work, provided each sample is identified and location recorded.

a. Directional sign.

b. Standard Room sign.

1.3 GENERAL

Interior signage shall be of the design, detail, sizes, types, and message content shown on the drawings/attachments/signage placement schedule (as applicable), shall conform to the requirements specified, and shall be

provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Signage shall be obtained from a single manufacturer with edges and corners of finished letterforms and graphics true and clean.

1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials shall be packaged to prevent damage and deterioration during shipment, handling, storage and installation. Product shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

2.1.1 Standard Room Signs

Signs shall consist of acrylic plastic 0.080 inch thickness minimum conforming to ANSI Z97.1 and shall conform to the following:

Units shall be frameless. Corners of signs shall be rounded to as indicated.

2.1.2 Type of Mounting For Signs

Extruded aluminum brackets shall be furnished for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners. Surface mounted signs shall be mounted with 1/16 inch thick vinyl foam tape fabricated from materials that are not corrosive to sign material and mounting surface.

2.1.3 Graphics

Signage graphics for modular signs shall conform to the following:

Subsurface copy: Copy is transferred to the back face of clear acrylic sheeting forming the panel face to produce precisely formed opaque image. This method bonds all sign elements (color, graphics, lettering, braille and substrate) into a single unit.

2.1.4 Character Proportions and Heights

Letters and numbers on indicated signs which do not designate permanent rooms or spaces shall be as indicated on the drawings.

2.1.5 Raised and Brailled Characters and Pictorial Symbol Signs (Pictograms)

Raised and brailled characters and symbols are only required on signs that designate permanent rooms or spaces, including restrooms and room numbers.

They are not required for information or way-finding signs. Raised letters and numbers on signs must protrude 1/32 inch upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch in height, but no higher than 2 inches. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 6 inches minimum in height. Indicated accessible facilities shall use the international symbol of accessibility.

2.2 INDIVIDUAL CUT PLASTIC LETTERS

2.2.1 Fabrication

Letters shall be fabricated from laser cut or waterjet acrylic. Letters shall be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters shall be packaged for protection until installation.

2.2.2 Typefaces, Thicknesses, Colors and Sizes

Typefaces, thicknesses, colors and sizes are indicated on signage schedule, Sheet A-181.

2.2.3 Mounting

Letters shall be surface mounted to painted surfaces with double sided adhesive tape. Templates for mounting shall be supplied.

2.3 FABRICATION AND MANUFACTURE

2.3.1 Factory Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.4 COLOR, FINISH, AND CONTRAST

Color shall be as indicated on the drawings. Finish of all signs shall be eggshell, matte, or other non-glare finish as required in handicapped-accessible buildings.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed plumb and true and in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Distance from edge of door frame to edge of sign shall be as indicated on drawings. Required blocking shall be installed. Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until

finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

3.1.1 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Sign surfaces shall be cleaned at completion of sign installation in accordance with the manufacturer's approved instructions.

-- End of Section --

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A385/A385M	(2009) Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products

INTERNATIONAL CODE COUNCIL (ICC)

ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60003	(Basic) Partitions, Toilet, Complete

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SYSTEM DESCRIPTION

Provide a complete and usable toilet partition system, including toilet enclosures, room entrance screens, urinal screens, system of panels, hardware, and support components. Furnish the partition system from a single manufacturer, with a standard product as shown in the most recent catalog data. Submit Fabrication Drawings for metal toilet partitions and urinal screens consisting of fabrication and assembly details to be performed in the factory. Submit manufacturer's Cleaning and Maintenance Instructions with Fabrication Drawings for review.

1.2.1 Sustainable Design Requirements

1.2.1.1 Local/Regional Materials Documentation

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D 1972. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual.

a. Type 2: High Density Polyethylene (HDPE).

b. Type 3: Vinyl (Polyvinyl Chloride or PVC).

c. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings
Installation Drawings;

SD-03 Product Data

Cleaning and Maintenance Instructions
Colors And Finishes;
Anchoring Devices and Fasteners
Hardware and Fittings
Brackets Door
Hardware

SD-04 Samples

Colors and Finishes;
Hardware and Fittings
Anchoring Devices and Fasteners

SD-07 Certificates

Warranty

1.4 REGULATORY REQUIREMENTS

Conform to ICC/ANSI A117.1 code for access for the handicapped operation of toilet compartment door and hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the manufacturer's original unopened packages with the brand, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated; free from dust, water, other contaminants, and damage during delivery, storage, and construction.

1.6 WARRANTY

Provide certification or warranties that metal toilet partitions will be free of defects in materials, fabrication, finish, and installation and will remain so for a period of not less than 5 years after completion.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Anchoring Devices and Fasteners

Provide steel anchoring devices and fasteners hot-dipped galvanized after fabrication, in conformance with ASTM A385/A385M and ASTM A123/A123M. Conceal all galvanized anchoring devices.

2.1.2 Brackets

Wall brackets shall be two-ear panel brackets, T-style, 1-inch stock. Provide stirrup style panel-to-pilaster brackets.

2.1.3 Hardware and Fittings

2.1.3.1 General Requirements

Conform hardware for the toilet partition system to CID A-A-60003 for the specified type and style of partitions. Provide hardware finish highly resistant to alkalis, urine, and other common toilet room acids. Comply latching devices and hinges for handicap compartments with 36 CFR 1191; provide stainless steel devices and hinges with door latches that operate without either tight grasping or twisting of the wrist of the operator. Submit three samples of each item, including anchoring devices and fasteners. Approved hardware samples may be installed in the work if properly identified.

a. Corrosion-resistant steel shall conform to ASTM A167, Type 304.

2.1.3.2 Finishes

a. Aluminum shall have a clear anodic coating conforming to AA DAF45.

b. Corrosion-resistant steel shall have a No. 4 finish.

c. Exposed fasteners shall match the hardware and fittings.

2.1.4 Door Hardware

2.1.4.1 Hinges

Hinges shall be adjustable to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors to 10 degrees. Provide self-lubricating hinges with the indicated swing. Hinges shall be the surface-mounted type and have the following type of return movement:

a. Gravity return movement

2.1.4.2 Latch and Pull

Latch and pull shall be a combination rubber-faced door strike and keeper equipped with emergency access.

2.1.4.3 Coat Hooks

Coat hooks shall be combination units with hooks and rubber tipped pins.

2.2 PARTITION PANELS AND DOORS

Fabricate partition panels and doors not less than 1 inch thick.

2.2.1 Toilet Enclosures

Conform toilet enclosures to CID A-A-60003, Type I, Style A, floor supported, C, overhead braced. Furnish width, length, and height of toilet enclosures as shown. Provide a width of 1 inch. Finish surface of panels shall be solid phenolic, Finish 4; water resistant; graffiti resistant; non-absorbent. Enclosures shall contain a minimum of 20 percent post-consumer recycled plastic. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. This item may contain post-consumer or post-industrial recycled content. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required. Provide grab bars to withstand a bending stress, shear stress, shear force, and a tensile force induced by 250 lbf. Grab bars shall not rotate within their fittings.

2.2.2 Urinal Screens

Conform urinal screens to CID A-A-60003, Type III, Style A, floor supported, C, overhead braced. Provide finish for surface of screens as solid phenolic, Finish 4; water resistant; graffiti resistant; non-absorbent. Screens shall contain a minimum of 20 percent post-consumer recycled plastic. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements.This item may contain post-consumer or post-industrial recycled content. Furnish width and height of urinal screens as shown. Provide thickness of 1 inch. Secure wall hung urinal screens with a minimum of three wall stirrup brackets. Fabricate screens from the same types of panels and pilasters as the toilet partitions. Use corrosion-resistant steel fittings and fasteners. Include in LEED Documentation Notebook.

2.3 FLOOR-ANCHORED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0635 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a steel bar not less than 1/2 by 7/8 inch welded to the reinforced face sheets and having not less than two 3/8 inch round anchorage devices for securing to the floor slab. Provide anchorage devices complete with threaded rods, expansion shields, lock washers, and leveling-adjustment nuts. Trim piece at the floor shall be 3 inch high and fabricated from not less than 0.030 inch thick corrosion-resistant steel.

2.4 OVERHEAD-BRACED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0393 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a channel-shaped floor stirrup fabricated from not less than 0.0635 inch thick material and a leveling bolt. Secure the stirrup to the pilaster with not less than a 3/16 inch bolt and nut after the pilaster is leveled. Secure the stirrup to the floor with not less than two lead expansion shields and sheetmetal screws. Fabricate overhead brace from a continuous extruded aluminum tube not less than 1 inch wide by 1-1/2 inch high, 0.125-inch wall thickness. Finish shall be AA-C22A31 in accordance with AA DAF45. Set and secure brace into the top of each pilaster. Fabricate 3 inch high trim piece at the floor from not less than 0.030 inch thick corrosion-resistant steel.

2.5 PILASTER SHOES

Provide shoes at pilasters to conceal floor-mounted anchorage. Pilaster shoes shall be stainless steel. Shoes shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Pilaster shoes may contain post-consumer or post-industrial recycled content. Height shall be 3 inches.

2.6 HARDWARE

Hardware for the toilet partition system shall conform to CID A-A-60003 for the specified type and style of partitions. Hardware shall be pre-drilled by manufacturer. Hardware finish shall be highly resistant to alkalis, urine, and other common toilet room acids. Latching devices and hinges for handicap compartments shall comply with 36 CFR 1191 and shall be stainless steel door latches that operate without either tight grasping or twisting of the wrist of the operator. Screws and bolts shall be stainless steel, tamper proof type.Wall mounting brackets shall be continuous, full height, stainless steel, in accordance with toilet compartment manufacturer's instructions. Floor-mounted anchorage shall consist of corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor.

2.7 COLORS AND FINISHES

2.7.1 Colors

Provide manufacturer's standard color charts for color of finishes for toilet partition system components. Submit three samples showing a finished

edge on two adjacent sides and core construction, each not less than 12-inch square

2.7.2 Finishes No.4

Provide solid plastic fabricated of solid phenolic core with melamine facing sheets formed under high pressure rendering a single component section not less than one inch thick. Colors shall extend throughout the panel thickness. Provide exposed finish surfaces: smooth, waterproof, non-absorbent, and resistant to staining and marking with pens, pencils, or other writing devices. Solid plastic partitions shall not show any sign of deterioration when immersed in the following chemicals and maintained at a temperature of 80 degrees F for a minimum of 30 days:

a. Acetic Acid (80 percent)	Hydrochloric Acid (40 percent)
b. Acetone	Hydrogen Peroxide (30 percent)
c. Ammonia (liquid)	Isopropyl Alcohol
d. Ammonia Phosphate	Lactic Acid (25 percent)
e. Bleach (12 percent)	Lime Sulfur
f. Borax	Nicotine
g. Brine	Potassium Bromide
h. Caustic Soda	Soaps
i. Chlorine Water	Sodium Bicarbonate
j. Citric Acid	Trisodium Phosphate
k. Copper Chloride	Urea; Urine
l. Core Oils	Vinegar

PART 3 EXECUTION

3.1 PREPARATION

Take field measurements prior to the preparation of drawing and fabrication to ensure proper fits. Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work. Verify correct spacing of plumbing fixtures. Verify correct location of built in framing, anchorage, and bracing. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install partitions rigid, straight, plumb, and level, with the panels centered between the fixtures. Provide a panel clearance of not more than 1/2 inch and secure the panels to walls and pilasters with not less than two wall brackets attached near the top and bottom of the panel. Locate wall brackets so that holes for wall bolts occur in masonry or tile joints. Secure Panels to pilasters with brackets matching the wall brackets. Provide for adjustment due to minor floor variations. Locate head rail joints at pilaster center lines. Install adjacent components for consistency of line and plane. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors.

a. Secure panels to hollow plastered walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

b. Secure panels to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

c. Secure panels to solid masonry or concrete with lead or brass expansion shields designed for use with not less than 1/4-20 screws, with a shield length of not less than 1-1/2 inch. Expansion shields shall have a load-carrying strength of not less than 600 pounds per anchor.

d. Submit Installation Drawings for metal toilet partitions and urinal screens showing plans, elevations, details of construction, hardware, reinforcing and blocking, fittings, mountings and escutcheons. Indicate on drawings the type of partition, location, mounting height, cutouts, and reinforcement required for toilet-room accessories.

3.3 FLOOR-ANCHORED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level tops of doors with tops of pilasters when doors are in a closed position. Expansion shields shall have a minimum 2-inch penetration into the concrete slab.

3.4 OVERHEAD-BRACED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Secure overhead brace to the pilaster face with not less than two fasteners per face. Expansion shields shall have a minimum 2-inch penetration into the concrete slab. Make tops of doors parallel with the overhead brace when doors are in a closed position.

3.5 FINAL ADJUSTMENT

After completion of the installation, make final adjustments to the pilaster-leveling devices, door hardware, and other working parts of the partition assembly. Doors shall have a uniform vertical edge clearance of approximately 3/16 inch and shall rest open at approximately 30 degrees when unlatched.

3.6 CLEANING

Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Clean all surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner compliant with the manufacturer's recommended cleaning and protection from damage procedures until accepted. Remove all equipment, tools, surplus materials, and work debris from the site.

-- End of Section --

SECTION 10 22 13

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wire mesh partitions;

Show layout, details, materials, dimensions, finishes, and all information necessary for fabrication and installation.

SD-03 Product Data

Wire mesh partitions;

Submit for each type of partition and door.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in manufacturer's original, unopened containers or packaging with labels intact and legible. Deliver, store, and handle

materials so as to prevent damage. Replace damaged or defective materials with new.

1.4 NOT USED

1.5 DESCRIPTION OF WORK

Wire mesh partitions shall be all wire type, heavy duty for extra heavy industrial use, and shall be provided complete with fasteners, capping bars, adjustable floor sockets, bracing, doors, hardware, and other items necessary for a complete, useable, and rigid installation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Shapes, Plates, and Bars

ASTM A36/A36M.

2.1.2 Cold-Formed Steel

AISI SG03-3.

2.1.3 Wire Mesh

Carbon steel wire, woven diamond mesh, intermediate crimped.

2.1.4 Floor Sockets

Cast or forged steel or ductile iron, adjustable, approximately 2-1/2 inches high.

2.2 NORMAL DUTY PARTITIONS

2.2.1 Wire Mesh

10 gage wire, 1-1/2 inch mesh.

2.2.2 Vertical Frames

1-1/4 by 5/8 inch cold-rolled C section channels or 1-1/4 by 5/8 by 1/8 inch channels.

2.2.3 Horizontal Frames

1 by 5/8 inch channels.

2.2.4 Center Reinforcing Bar

One 1 by 1/2 by 1/8 inch channel with all wires woven through, or two 1 by 3/8 by 1/8 inch channels bolted together with mesh in between.

2.2.5 Capping Bar

2-1/4 by one by 1/8 inch channel or 2 by 1/4 inch flat bar.

2.2.6 Corner Posts

Structural steel angles, 1-1/4 by 1-1/4 by 1/8 inch.

2.2.7 Line Posts

Unless otherwise indicated, provide partitions more than 12 feet high with flat bar line posts bolted between vertical frame channels. Sizes of posts shall be as follows:

Partition Height	Size of Posts
12 feet to 14 feet 8 inches	1-3/4 by 5/16 inch or 2 by 1/4 inch
14 feet 8 inches to 19 feet 8 inches	2-1/2 by 5/16 inch
19 feet 8 inches to 23 feet 8 inches	3 by 5/16 inch

2.2.8 Hinged Doors

Frames shall be 1-1/4 by 1/2 by 1/8 inch channels with 1-1/4 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-3/8 by 3/4 by 1/8 inch angle riveted to the lock stile. Provide 1 1/2 pairs of regular weight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

2.2.9 Sheet Metal Base

Hot- or cold-rolled sheet steel, not lighter than 16 gage.

2.3 HEAVY DUTY PARTITIONS

2.3.1 Wire Mesh

6 gage wire, 2 inch mesh.

2.3.2 Panel Frames

1-1/2 by 3/4 by 1/8 inch steel channels.

2.3.3 Center Reinforcing Bar

One 1-1/2 by 3/4 by 1/8 inch channel with all wires woven through, or two 1-1/4 by 3/8 by 1/8 inch channels bolted together with mesh in between.

2.3.4 Capping Bar

Structural steel channel, 3 inch by 4.1 pounds.

2.3.5 Corner Posts

Structural steel angles, 1-3/4 by 1-3/4 by 1/8 inch.

2.3.6 Line Posts

Unless otherwise indicated, provide partitions with flat bar line posts bolted between vertical frame channels. Sizes of posts shall be as follows:

Partition Height	Size of Posts
7 feet to 12 feet	2-1/2 by 5/16 inch
12 feet to 16 feet	3 by 5/16 inch or 2-1/2 by 3/8 inch
16 feet to 20 feet	3-1/2 by 5/16 inch

2.3.7 Hinged Doors

Frames shall be 1-1/2 by 3/4 by 1/8 inch channels with 1-1/2 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-5/8 by 7/8 by 1/8 inch angle riveted to the lock stile. Provide 1-1/2 pairs of heavyweight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

2.4 DOOR OPENING FRAMES

Provide frames the same size and shape as the vertical frames for the mesh panels.

2.5 LOCKS

Provide each door with a mortise type lock as coordinated with the COR.

2.6 FABRICATION

2.6.1 Standard Panels

Wire shall be woven into diamond mesh, intermediate crimped, and securely clinched to frames. Joints shall be mortised and tenoned. Wire shall be continuous at center reinforcing bars, either woven through a single channel or bolted between two channels. Panel vertical frames shall have 3/8 inch bolt holes 18 inches o.c. for heavy duty partitions.

2.6.2 Doors

Construction shall be similar to that specified for panels. Wire mesh shall be the same as that used in the adjacent partition panels.

2.6.3 Finish

Thoroughly clean ferrous metal, treat with phosphate, and paint with gray enamel in the shop.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wire Mesh Partitions

Install plumb, level, and true to line, within a tolerance of 1/8 inch in 10 feet or the height or run of the partition, if less than 10 feet. Anchor floor sockets to the floor with expansion bolts. Vertical frames and posts

shall be bolted together with 3/8 inch bolts 18 inches o.c. for heavy duty partitions. Secure top frames to a continuous capping bar with 1/4 inch diameter U bolts not more than 28 inches o.c.

3.1.2 Doors

Install in accordance with the manufacturers' recommendations. Adjust as required so that doors and hardware operate freely and properly.

3.1.3 Bracing

Brace free standing partitions more than 20 feet in length, at intervals not greater than 20 feet with a steel channel brace connected to the capping bar and anchored to the building wall or framing member.

3.1.4 Touch-Up

Clean and paint scratches, abrasions, and other damage to shop painted surfaces to match the shop-applied finish.

-- End of Section --

SECTION 10 26 13

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D 256	(2010) Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D 543	(2006) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 21	(2009) Determining Resistance of Synthetic Polymeric Materials to Fungi

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(2005) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards;
Wall Guards (Bumper Guards);
Wall Covering/Panels;

SD-04 Samples

Finish;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep materials dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 70 degrees F for at least 48 hours prior to installation.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

To the maximum extent possible, corner guards, door and door frame protectors, wall guards (bumper guards), wall panels and wall covering shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Provide resilient material consisting of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic conforming to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 18 ft-lbs/sq. inch when tested in accordance with ASTM D 256, (Izod impact, ft-lbs per sq inch notched).

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.4 Chemical and Stain Resistance

Materials shall be resistant to chemicals and stains reagents in accordance with ASTM D 543.

2.1.1.5 Fungal and Bacterial Resistance

Materials shall be resistant to fungi and bacteria in accordance with ASTM G 21, as applicable.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards

Corner guard units shall be surface mounted type, radius formed to profile shown. Corner guards shall be 8 feet high. Mounting hardware, cushions, and base plates shall be furnished. Assembly shall consist of a snap-on corner guard formed from high impact resistant resilient material, mounted on a continuous aluminum retainer. Extruded aluminum retainer shall conform to ASTM B221, alloy 6063, temper T5 or T6. Flush mounted type guards shall act as a stop for adjacent wall finish material. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards. Flush mounted corner guards installed in fire rated wall shall maintain the rating of the wall. Insulating materials that are an integral part of the corner guard system shall be provided by the manufacturer of the corner guard system. Exposed metal portions of fire rated assemblies shall have a paintable surface.

2.2.2 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 18 gauge thick material conforming to ASTM A167, type 302 or 304. Corner guards shall be 8feet high. Corner guard shall be formed to dimensions shown.

2.3 WALL COVERING/PANELS

Provide wall covering/panels consisting of high impact rigid acrylic vinyl or polyvinyl chloride resilient material. Panel sizes shall be 4 x 8 feet. Submit fire rating and extinguishing test results for resilient material. Also submit statements attesting that the items comply with specified fire and safety code requirements.

2.3.1 Rigid Vinyl Acrylic Wall Covering

Wall covering thickness shall be 0.040 inch.

2.4 TRIM, FASTENERS AND ANCHORS

Provide vinyl trim, fasteners and anchors for each specific installation as shown.

2.5 FINISH

Submit three samples indicating color and texture of materials requiring color and finish.

2.5.1 Aluminum Finish

Finish for aluminum shall be in accordance with AA DAF45. Exposed aluminum shall be designation AA-C22A31 chemically etched medium matte, with clear anodic coating, AA-C22A32 chemically etched medium matte with integrally colored anodic coating class II architectural coating 0.4 mil thick. Concealed aluminum shall be mill finish as fabricated, uniform in natural color and free from surface blemishes.

2.5.2 Stainless Steel Finish

Finish for stainless steel shall be in accordance with ASTM A167, Type 302 or 304, finish number 4.

2.5.3 Resilient Material Finish

Finish for resilient material shall be embossed stipple texture with colors in accordance with SAE J1545.

2.6 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.7 COLOR

Color shall be as indicated on the drawings and selected from manufacturers standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

3.1.2 Door, Door Frame Protectors, and Wall Panels

Surfaces to receive protection shall be clean, smooth, and free of obstructions. Protectors shall be installed after frames are in place, but prior to hanging of doors, in accordance with manufacturer's specific instructions. Adhesives shall be applied in controlled environment in accordance with manufacturer's recommendations. Protection for fire doors and frames shall be installed in accordance with NFPA 80.

3.1.3 Stainless Steel Guards

a. Mount guards on external corners of interior walls, partitions and columns as in accordance with manufacturer's recommendations.

b. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards as indicated and expansion bolted to concrete or masonry with four 3/8 inch diameter bolts, spaced 16 inches on centers. Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Corner guards shall overlap finish plaster surfaces.

c. Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, anchor corner guards to existing walls with 1/4 inch oval head stainless steel countersunk expansion or toggle bolts. Grout spaces solid between guards and backing with portland cement and sand mortar.

d. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

e. For wall guards, space brackets at no more than 3 feet on centers and anchor to the wall in accordance with the manufacturer's installation instructions.

-- End of Section --

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1036 (2006) Standard Specification for Flat Glass

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes;
Accessory Items;

SD-04 Samples

Finishes;
Accessory Items;

1.3 DELIVERY, STORAGE, AND HANDLING

Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited for use with the supporting construction. Provide tamperproof design exposed fasteners with finish to match the accessory.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

Metal	Finish
Stainless steel	No. 4 satin finish

2.2 ACCESSORY ITEMS

Conform to the requirements for accessory items specified below. Submit fasteners proposed for use for each type of wall construction, mounting, operation, and cleaning instructions and one sample of each other accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted. Submit certificate for each type of accessory specified, attesting that the items meet the specified requirements.

2.2.1 Facial Tissue Dispenser (FTD)

Provide surface mounted facial tissue dispenser, Type 304 stainless steel face, satin finish. Secure face of recessed dispenser by friction with suitable spring steel clips. Provide a minimum capacity of 150 two-ply tissues for dispenser.

2.2.2 Grab Bar (GB)

Provide an 18 gauge, 1-1/4 inch grab bar OD Type 304 stainless steel. Provide form and length for grab bar as indicated. Provide concealed mounting flange. Provide grab with satin finish. Furnish installed bars capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 1-1/2 inch space between wall and grab bar.

2.2.3 Mirrors, Glass (MG)

Provide Type I transparent flat type, Class 1-clear glass for mirrors. Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.4 Paper Towel Dispenser (PTD)

Provide paper towel dispenser constructed of a minimum 0.03 inch Type 304 stainless steel, surface mounted. Furnish tumbler key lock locking mechanism.

2.2.5 Sanitary Napkin Disposer (SND)

Construct a Type 304 stainless steel sanitary napkin disposal with removable leak-proof receptacle for disposable liners. Provide fifty disposable liners of the type standard with the manufacturer. Retain receptacle in cabinet by tumbler lock. Provide disposer with a door for inserting disposed napkins, surface mounted.

2.2.6 Sanitary Napkin and Tampon Dispenser (SNTD)

Provide sanitary napkin and tampon dispenser surface mounted. Dispenser, including door of Type 304 stainless steel that dispense both napkins and tampons with a minimum capacity of 20 each. Furnish dispensing mechanism for complimentary operation. Hang doors with a full-length corrosion-resistant steel piano hinge and secure with a tumbler lock. Provide keys for coin box different from the door keys.

2.2.7 Soap Dispenser (SD)

Provide soap dispenser surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.8 Toilet Tissue Dispenser (TTD)

Furnish Type II - surface mounted toilet tissue holder with two rolls of standard tissue mounted horizontally. Provide stainless steel, satin finish cabinet.

2.2.9 Waste Receptacle (WR)

Provide Type 304 stainless steel waste receptacle, designed for surface mounting. Provide reusable liner, of the type standard with the receptacle manufacturer. Provide a minimum 15 cubic feet capacity. Provide receptacles with push doors and doors for access to the waste compartment with continuous hinges. Furnish tumbler key lock locking mechanism.

2.2.10 Toilet Seat Cover Dispenser (TSCD)

Provide Type 304 stainless steel with surface mounted toilet seat cover dispensers. Provide dispenser with a minimum capacity of 500 seat covers.

2.2.11 Mop and Broom Holder (MH)

Stainless steel with grip jaw cam mechanism securing 4 mop or broom handles. Also includes hooks and storage shelf.

PART 3 EXECUTION

3.1 INSTALLATION

Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Provide oval exposed screw heads. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the

installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone or polysulfide sealant) as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates.Install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

-- End of Section --

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFC	(2009) International Fire Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1	(2009) Fire Code
NFPA 10	(2010) Standard for Portable Fire Extinguishers
NFPA 101	(2012) Life Safety Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.157	(2003) Portable Fire Extinguishers

UNDERWRITERS LABORATORIES (UL)

UL 299	(2002; Reprint Apr 2009) Dry Chemical Fire Extinguishers

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit Manufacturer's catalog and warranty data for the following items:

Cabinets;
Wall Brackets;

1.3 DELIVERY, HANDLING, AND STORAGE

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

PART 2 PRODUCTS

2.1 NOT USED

2.2 NOT USED

2.3 NOT USED

2.4 NOT USED

2.5 CABINETS

2.5.1 Material

Provide corrosion-resistant steel cabinets.

2.5.2 Type

Provide semi-recessed cabinet for a 4-inch wall.

2.5.3 Size

Dimension cabinets to accommodate the specified fire extinguishers.

2.6 WALL BRACKETS

Provide wall-hook fire extinguisher wall brackets.

Provide wall bracket and accessories as approved.

PART 3 EXECUTION

3.1 INSTALLATION

Install where indicated on the drawings. Verify exact locations prior to installation.

Comply with the manufacturer's recommendations for all installations.

3.2 ACCEPTANCE PROVISIONS

3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

3.2.2 Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

-- End of Section --

SECTION 11 13 10

DOCK LEVELERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS C2.18	(1993; Errata 1993) Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A143/A143M	(2007) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA MG 1	(2009) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 943 (2006; Reprint May 2010) Ground-Fault Circuit-Interrupters

1.2 DEFINITIONS

1.2.1 Industrial Dock Leveler

A manufactured structure designed to span and compensate space and height differentials between a loading dock and freight carrier to facilitate safe, efficient, freight transfer.

1.2.2 Adjustable Loading Ramp

Synonym for Fixed Type Industrial Dock Leveler.

1.2.3 Fixed Type Industrial Dock Leveler

A dock leveler that is permanently affixed to the dock structure, and usually incorporating an electro-hydraulic recessed into dock face further than 15 inch system to position the dock leveler with respect to the freight carrier at the lip end while being fixed at the opposite hinged end.

1.2.4 Velocity Fuse

A valve or similar device that goes into the hydraulic line. If the dock leveler becomes inadvertently or accidentally unsupported, this fuse will freeze the movement of dock leveler within 4 inches of the dock leveler original position.

1.2.5 Carrier

A wheeled, enclosed trailer or container that, when attached to a heavy-duty truck or van, is used to carry bulk freight over long distances.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Loading Dock Levelers; G
Dock Bumpers; G

SD-04 Samples

Fastening Materials
Angles
Rods
Fastening Hardware

Dock Bumpers
Rubber Rubberized
Fabric

SD-07 Certificates

Fastening Materials
Rubberized Fabric
Steel Angles
Hardware Items

SD-10 Operation and Maintenance Data

Loading Dock Levelers, Data Package 3; G

SD-11 Closeout Submittals

Record Drawings; G

1.4 QUALITY ASSURANCE

1.4.1 Manufacturer's Representative

Furnish services of Fixed Type Industrial Dock Leveler technicians, experienced in installation and operation of the type of system being provided, to supervise installation, testing, adjustment of system, and instruction to Government personnel.

1.4.2 Detail Drawings

Submit drawings depicting dimensions, tolerances, surface finishes, hardness, flush edge angles, method of mounting and anchoring, and control schematics and diagram. Show complete wiring, schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show proposed layout and anchorage of equipment and appurtenances on Drawings. Show the concrete pit details including flush edge angles, dock bumpers including fastening materials in compliance with ASTM A123/A123M and ASTM D 2000, and sloped pit bottom; method of mounting and anchoring; and location of control stations and disconnect switches on Drawings. For vertical, edge-of-dock, and free-standing board dock levelers, show details of required pit or foundation construction and dock bumpers and structural shapes installation, in lieu of concrete pit details on Drawings. Show all proposed dock bumper locations on drawings.

1.4.3 Record Drawings

Submit record as-built drawings depicting dimensions, tolerances, surface finishes, harnesses, flush edge angles, method of mounting and anchoring, and control schematics and diagram, including mechanical and electrical components, testing and acceptance (one copy sepia transparency) for each industrial dock leveler.

1.5 DELIVERY, STORAGE, AND HANDLING

Matchmark and tag parts which are disassembled for shipment with metal tags. Provide waterproofed tags and markings. Protect the delivered equipment in

storage from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.6 EXTRA MATERIALS

After approval of the detail drawings, and not later than 2 months prior to the date of beneficial occupancy, provide spare parts data for each different item of material and equipment specified. Furnish a complete list of parts and supplies, with current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 3 year(s) of service.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Standard Products

Submit data including a complete list of equipment and materials, manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Provide materials and equipment, which are the standard products of a manufacturer regularly engaged in the manufacture of the products, and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this Section, with the additions and modifications specified herein.

2.1.2 Exposed Surfaces

All exposed metal surfaces and fastening materials shall fully comply with the minimum requirements of ASTM A123/A123M, ASTM A143/A143M, and ASTM A153/A153M.

2.1.3 Nameplate

Attach corrosion-resistant metal plate securely and legibly on the exterior surface of the dock leveler. Include the following information indented or embossed on the plate:

a. Description of the equipment: Describe procedures for operating and services equipment, and warnings or cautions of hazardous procedures.

b. Name of the manufacturer.

c. Serial and model number.

d. Rated capacity in pounds.

e. Shipping weight.

f. Date of manufacture (month and year).

2.1.4 Toe Guards or Skirts

Provide sides or edges, except front and rear edges, of the ramps which rise above the surrounding loading dock with sheet carbon steel skirts or toe guards of minimum 14 U.S.S. gage nominal thickness. Furnish smooth faced toe guards or skirts and mount flush with the edges of the ramp surface. Ensure sufficient depth of toe guards or skirts to protect the full operating range of dock travel. Ensure the construction capable of resisting a minimum lateral force of 10 pounds with a maximum deflection of 1/2 inch.

2.2 LOADING DOCK LEVELERS

Provide permanent loading dock levelers with minimum performance characteristics based on the following:

a. Service Period:
   (1) Number of shift operations: 2.
   (2) Maximum number of trucks per shift opening: 4.
   (3) Maximum number of days per week: 7.

b. Fork Lift Loads:
   (1) Design levelers to accommodate 3 and 4 wheel fork trucks.
   (2) Design levelers to handle 20,000 LB gross dynamic load.
   (3) Base load leveler design on number of cycles per loading/unloading operation per truck.

Provide loading dock leveler with electro-hydraulic type with electric motor and hydraulic pump operating a hydraulic cylinder that adjusts dock leveler board position. Make provision for maintenance access to understructure and lifting mechanism. Provide steel tread plate lip and platform, hinged and supported from beneath by steel framework that contains lifting, positioning, and lowering assembly. Ensure that platform surface is flush with surrounding floor surface of loading dock when not in service. Provide integral positive restraint when leveler is in maintenance position.

2.2.1 Design Requirements

Design, fabricate, and finish loading ramp to permit washing with water and detergents, and operating in an ambient temperature from 0 to plus 110 degrees F.

2.2.2 Dock Leveler Height Adjustment

Provide a ramp whose incline can be adjusted to suit the height of the freight carrier. Allow the loading ramp a minimum of 24 inches of vertical adjustment. Divide height adjustments 12 inches above and 12 inches below the dock level to provide coverage between 30 and 54 inches and 44 inches above grade.

2.2.3 Dock Leveler Extension and Retraction

Extend non-fixed end of the dock leveler from a retracted position behind the line of the loading dock platform bumpers to at least 12 inches beyond the forward edge of the dock platform bumpers so as to rest on the bed of the freight carrier. The difference in length of the platform from its fully retracted position to its fully extended position shall be practically constant throughout the ramp, including the ramp extension.

2.2.4 Loading Ramp Compensation

Provide automatic compensation with ramp platform loaded or unloaded for:

2.2.4.1 Freight Carrier Out of Level

Out of level freight carrier bed condition (difference in elevation from side to side at the rear of the carrier bed): Allow a minimum correction of one inch for each 18 inches and maximum 4 inch correction of ramp width over the width of the ramp. Ensure the rear edge of the ramp parallel with the rear of the frame in order to prevent tripping or be a pinching hazard.

2.2.4.2 Loading and Unloading of the Freight Carrier

Provide mechanical type dock levelers with manual load compensation for truck beds lowered below dock height. When the lip is extended so as to rest on the bed of motor truck or trailer, provide compensation of 4 inches for carrier spring deflection so that contact will be maintained between lip and carrier bed.

2.2.5 Safety Devices

2.2.5.1 Electro-Hydraulic System

Provide velocity fuse, ballcheck valve, or other device to automatically prevent a drop of more than 4 inches of the lip, should the freight carrier move away from the dock leaving the lip unsupported. Activate this device with a static, dynamic, or impact load exceeding 10 percent of the rated load on the lip and ramp.

2.2.5.2 Dock Bumpers

Submit certificates showing conformance with the referenced standards contained in this section. Provide ramp and load dock face with laminated rubber, tire-fabric, or equivalent dock bumpers recommended by the dock leveler manufacturer. Submit one typical Loading Dock Bumper completely assembled with supporting rods, end angles, bolts, and nuts. (This may be the smallest size bumper required.) One section of 8 inches wide by full depth and height of bumper including one end angle with the opposite end exposed for inspection.Solid Rubber pieces conforming to ASTM D 2000, Grade 4AA612A13B13F17 may be used instead of rubberized fabric.

a. Construct bumpers of resilient, laminated, rubberized-fabric pads, assembled on steel frames. Rubberized Fabric shall conform to ASTM D 2000. Punch material to receive 3/4 inch supporting rods. Bumpers shall be 4-1/2 inches thick, stand out from the dock, and be closed with two structural steel angles under 1,500 pounds.

b. Finish: Metal for dock bumpers, including Hardware Items, shall be hot-dip galvanized conforming to ASTM A123/A123M.

2.2.6 Rated Capacity

Minimum 20,000 pounds roll over capacity.

2.2.7 Ramp Load Carrying Surface

The live load carrying surface of the ramp shall be 6 feet plus or minus 3 inch wide and 10 feet plus or minus 9 inch long with the dock leveler lip retracted.

2.3 OPERATION

2.3.1 Electro-Hydraulic Control

Provide each dock leveler with a pushbutton station to activate motor, pump, and valves.

2.3.1.1 Pushbutton

Heavy-duty dust tight and oil tight type rated in accordance with NEMA ICS 2, Part ICS2-216 for alternating current. To prevent accidental operation and damage, ensure each button to be recessed in its station or be protected by a peripheral collar (ring) or shroud. Indelibly identify each pushbutton by means of cast or etched letters on the station. Provide emergency "STOP" button of momentary type with manual reset or continuous pressing (constant pressure) type. This stop button shall stop all dock leveler movement, regardless of the position of the ramp or lip at the time the "STOP" button is depressed.

2.3.1.2 Hinged Lip Ramp Movement

Apply continuous pressure on the "UP" button to raise the loading ramp, descend the lip onto the bed of the freight carrier. Once the freight carrier has departed, the lip shall automatically fall or retract to its down position, and the ramp shall return to its stored dock level position. The ramp, in its stored position, shall have the capability of being lowered below dock level without extending the lip of the ramp to service truck end loads which may be lower than loading dock surface position. Allow 4 to 6 seconds to fully extend or retract the lip.

2.4 CONSTRUCTION AND MATERIALS

Construct all load carrying parts of forged or welded steel. The entire live load carrying surface of the ramp and rear attachment shall be not less than 1/4 inch thick, 55 ksi minimum yield strength, low alloy, nonskid steel tread plate. Provide minimum 5/8 inch vertical projections on the live load carrying surface. Bevel the lip or ramp extension. Design load carrying surfaces to permit free movement of powered hand or platform trucks, low lift pallet trucks, and fork lift trucks. Fabricate lip hinge of not less than 1/4 inch wall seamless steel tubing.

2.5 ELECTRO-HYDRAULIC SYSTEM

Provide a separate and complete system for each dock leveler. Include an electric motor, motor drive, hydraulic pump, hydraulic ram, pressure relief valve, fluid reservoir, strainer, filter, hydraulic control-valve cylinders, hose, piping, fittings, and hydraulic fluid. Incorporate a means for filling and draining hydraulic fluid. Design cylinders, pump, and control valves to withstand not less than 150 percent of the design operating pressure. Provide hydraulic hose, fittings, pipe, and tubing with working pressures based upon a minimum 4 to 1 safety factor of bursting pressure.

2.6 ELECTRICAL REQUIREMENTS

NFPA 70, NEMA ICS 2, NEMA ICS 6 and NEMA MG 1. Provide 230 volt electrical characteristics, three phase, 60 Hz alternating current power supply. Provide all electrical equipment on the loading ramp. Provide interconnecting wiring for components of packaged equipment as an integral part of the equipment. Include motor, switches, junction box, conduit, wiring cables, panel enclosed control station, motor controller, heater coils, timer, transformer, terminal blocks, and fuses. Provide NEMA ICS 6, Type 4, electrical enclosures. Color code all wiring.

2.6.1 Motor

Conform to NEMA MG 1 and continuous duty or 60-minute time rated, industrial type, single speed rated for operating conditions. Provide electrical insulation systems conforming to NEMA MG 1, Class B. Provide permanently lubricated antifriction ball or roller bearings. Equip each electrohydraulic loading dock leveler with a totally enclosed fan cooled (TEFC) squirrel cage induction electric motor. Equip each air powered loading dock leveler with a 115v, single phase, 60 Hz, self cleaning, two stage, UL approved industrial fan motor, which will not exceed its rated capacity under full load conditions of the loading dock leveler.

2.6.2 Controls

NEMA ICS 2, size 0 controller for heavy industrial service. Provide an electrically operated, full magnetic, nonreversing type controller for the motor. Equip all control enclosures with locks and keys.

2.6.3 Transformer

Totally enclosed, self-cooled, dry type. Feed the transformer from the load side of the main disconnecting device. Incorporate circuit breakers with ground fault interrupting protection conforming to UL 943.

2.7 ACCESSORIES

2.7.1 Dock Bumpers

Provide bumpers capable of sustaining repeated impacts from trucks or trailers without damage to the dock, dock levelers, or bumpers.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

Install and adjust in accordance with NFPA 70, manufacturer's approved detail drawings, and as-built system assembly drawings. Install controls so operator can see dock leveler while manipulating controls. Do not pour the pit for the adjustable loading ramp until the design and detail drawings have been approved. If the pit size is limited by construction conditions

involved, alter the dock leveler equipment to fit the pit. Clearly indicate these alterations or modifications on the drawings. Check and verify the appropriate measurements at the building. Do not exceed 2 inch clearances between the ramp and pit.

3.3 CLEANING, TREATMENT AND PAINTING

In accordance with manufacturer's standard practice, shop clean, treat and paint ferrous surfaces including platform, lip, frame, springs, motor, pump, cylinders, valves, and any other non-cadmium plated or non-galvanized surface (but not including bearings, gear contact surfaces, parts protected by lubrication, or other surfaces not usually painted or coated). Clean ferrous surfaces, shot pen, and protect the base metal with an application of 99.9 percent pure zinc coating with a thickness of 0.010 to 0.012 in accordance with AWS C2.18 and protect the base metal with an application of Rustoleum paint with a thickness of 2.5 to 3 mils followed by a final coat of standard primer with a thickness of 2.5 to 3 mils. Protect nonferrous parts against corrosion as necessary.

3.3.1 Workmanship

Conduct field touch-up work as to avoid damaging other surfaces and public property in the area. Do not apply field applied paint during foggy, damp, rainy weather, or the ambient temperatures below 45 degrees F and above 95 degrees F.

3.3.2 Dissimilar Metals Protection

Insulate control surfaces by electrolytically inactive materials.

3.3.3 Finish Coat Color

Brilliant yellow and black. Paint 3 inch wide black and yellow diagonal stripes on all vertical surfaces of pit, skirts, and platform edges exposed above adjacent surfaces at any ramp position. Paint similar stripes on top of ramp surfaces in 6 inch wide band around outside edges (except for fixed edge).

3.4 FIELD TESTS

Provide personnel, instruments, materials, and equipment, including test vehicles, for the administration and direction of the tests. Correct defects and repeat tests under the cognizance of the Contracting Officer and the dock leveler manufacturer. The Contracting Officer is responsible for certifying the test load.

3.4.1 Roll-Over Load Tests

Move roll-over load of 20,000 pounds over the dock leveler between the bed of a freight carrier and the building loading dock surface for 10 cycles. With the ramp extension retracted and the ramp platform leveled with the building loading dock surface, run a 20,000 pound roll-over load over the ramp in various directions for 20 cycles. Do not allow permanent deformation or hydraulic system leakage to occur subsequent to examination after these roll-over tests.

3.4.2 Drop Tests

Twice, drop test the dock leveler at the indicated rated capacity as follows: With the load on the platform and the lip resting on a vehicle carrier bed not less than 10 inches above loading dock surface, pull the carrier or pull away from the lip, leaving the loading ramp unsupported. Do not exceed 4 inch for the measured vertical drop of the dock leveler taken at the point where the lip rests on the vehicle carrier during each of the drop tests. Inspect the loading ramp after each drop and ensure no damage or distortion to the mechanical, electrical or structural components. Do not allow leakage from the hydraulic system.

3.4.3 Acceptance Tests

Perform an acceptance test in the presence of the dock leveler manufacturer and the Contracting Officer subsequent to roll-over load tests and drop tests. Conduct operation of the equipment through all of its motions and specified checks as follows: (a) extend lip to rest on a variety of freight carriers with beds up 12 inch above and below dock level; (b) test 4 inch drop limitation with 7000 pound load on ramp, evenly distributed; (c) test level compensation with the ramp, loaded with a minimum of 7000 pounds; and (d) test proper compensation (float) for various compression of countersprings, with ramp loaded and unloaded.

3.5 INSTRUCTION TO GOVERNMENT PERSONNEL

Upon completion of the work and at a time designated by the Contracting Officer, provide the services of a competent Technician regularly employed or authorized by the manufacturer of the dock leveler to instruct Government personnel in the proper operation, maintenance, safety, and emergency procedures of the dock leveler. A minimum of one and no more than two eight-hour working days of instruction is required. Conduct the training at the job site or at any other location mutually satisfactory to the Government and the Contractor.

3.6 OPERATING MANUALS

Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. List routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides in the maintenance manuals. Also include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

-- End of Section --

SECTION 12 21 00

WINDOW BLINDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2004) Fire Tests for Flame Propagation of Textiles and Films

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES

SD-03 Product Data

Window Blinds;
Hardware;
Installation

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Samples

Window Blinds;
Hardware;

Samples of each type and color of window treatment. Provide plastic vertical louvers 6 inch in length for each color. Track must be 6 inch in length. Shade material must be minimum 6 by 6 inch in size.

SD-06 Test Reports

Window Blinds

Fire resistance, Flame Spread, and smoke contribution data.

SD-08 Manufacturer's Instructions

Window Blinds;

SD-10 Operation and Maintenance Data

Window Blinds;

1.3 GENERAL REQUIREMENTS

Provide window treatment, conforming to NFPA 701, complete with necessary brackets, fittings, and hardware. Each window treatment type must be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Mount and operate equipment as per manufacturer's instructions. Windows to receive a treatment must be completely covered.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above 50 degrees F. Do not open containers until needed for installation unless verification inspection is required.

1.5 FIELD MEASUREMENTS

Become familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Provide each blind, including hardware, accessory items, mounting brackets and fastenings, as a complete unit produced by one manufacturer. All parts must be one color, unless otherwise indicated, to match the color of the blind slat. Treat steel features for corrosion resistance.

2.1.1 Vertical Blinds

Provide vertical blind units capable of nominally 180 degree partial tilting operation and full stackback. The blinds must be listed by the manufacturer as designed for heavy duty strength applications including heavy duty hardware. Provide vertical blinds to be wall mounted with inside brackets. Blinds must be sill length. Outside mount type installation must provide adequate overlap to control light and privacy.

2.1.1.1 Louvers

Provide louvers which are fire resistant solid vinyl, UV stable, and impact resistant; having a bottom chain. Louvers that are 3-1/2 inch must overlap not less than 3/8 inch.

2.1.1.2 Carriers

Provide carriers to support each louver. Provide carriers made of molded plastic to transverse on self-fabricated wheels for smooth, easy operation.

The hook of the carrier must have an automatic latch to permit easy installation and removal of the louver, and to securely lock the louver for tilting and traversing.

2.1.1.3 Headrail System

Provide headrail system not less than 0.047 inch thick and made of anodized aluminum alloy or 0.027 inch thick phosphate treated steel with a baked on ivory gloss enamel paint finish. The headrail must extend the full width of the blind and be closed with an end cap at each end. One cap must contain the traversing and tilting controls. The opposite cap will house the pulley for the traversing cord.

2.1.1.4 Valance

Attach the manufacturer's standard valance to the headrail by metal holders which grip the top and bottom edge of the valance and accept an insert of the same material as the slats. Provide sufficient clearance behind the valance to permit the louvers to tilt without interference. The headrail cover must extend the full width of the blind.

2.1.1.5 Controls

Provide tilting and traversing controls that hang compactly at the side of the blinds and reach within 40 inches of the floor. The tilt/traverse control must tilt all vanes simultaneously to any desired angle and hold them at that angle. Provide louvers that traverse one way to the right. The traversing control cord must be minimum 0.070 inch in diameter with a minimum breaking strength of 125 pounds. Anchor the cord to a lead carrier linked to all adjacent carriers. Provide louvers that traverse along the headrail by pulling one side of the looped cord a fiberglass wand that tilts the louvers by turning the wand and traverses the louvers by using the wand as a drapery control. Sliding glass doors must have a one way draw with stackback occurring opposite door openings.

2.1.1.6 Connectors and Spacers

The connector must be flexible, smooth and flat to slide unhindered when carriers move independently of each other, and to nest compactly when carriers are stacking. The length of the links must relate to the louver width in order to equally space the traversing louvers, to maintain uniform and adequate overlap of louvers, and to fully cover the width of the opening.

2.2 COLOR

Provide color, pattern and texture as indicated on the drawings selected from manufacturer's standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Vertical Blinds

Perform installation in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.1.2 Valance

Perform installation in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.2 CLEAN-UP

Upon completion of the installation, free window treatments from soiling, damage or blemishes; and adjust them for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Contracting Officer. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, must be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 0.75 inch or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

-- End of Section --

SECTION 12 36 00

COUNTERTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2009) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM D 4689	(1999; R 2005) Standard Specification for Adhesive, Casein-Type
ASTM D 4690	(1999; R 2005) Standard Specification for Urea Formaldehyde Resin Adhesives
ASTM F 594	(2009e1) Standard Specification for Stainless Steel Nuts
ASTM F 836M	(2002; R 2010) Standard Specification for Style 1 Stainless Steel Metric Nuts

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1	(2000) Performance & Construction Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION (SEFA)

SEFA 7	(1996) Recommended Practice for Laboratory and Hospital Service Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588	(Rev E; Notice 1) Bolt, Toggle: and Expansion Sleeve, Screw
FS FF-S-325	(Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS TT-C-490	(Rev E) Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings
FS TT-C-520	(Rev B; Notice 1) Coating Compound, Bituminous, Solvent Type, Underbody (for Motor Vehicles)
FS TT-F-336	(Rev E; Notice 2) Filler, Wood, Paste
FS WW-P-541	(Rev E; Am 1) Plumbing Fixtures

1.2 SUBMITTALS

Submitin accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Submit fabrication drawings for Countertop and Backsplash Fabrication, specified in this section.

SD-03 Product Data

Submit Manufacturer's catalog data for the following items:

Corrosion-Resistant Steel
Hardwood
Synthetic resin
Adhesives
Filler Material
Particle Board
Fasteners Steel
Sinks
Service Fixtures
Accessories and Hardware
Plastic Laminate

SD-04 Samples

Include samples for the following:

Countertop and Backsplash, one each, 4 inches in width, submitted as one unit or as separate items.

Accessories and Hardware, one each.

Submit Manufacturer's Standard Color Charts in accordance with paragraph entitled, "General," of this section.

SD-08 Manufacturer's Instructions

Submit Manufacturer's Instructions for in accordance with paragraph entitled, "General," of this section.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle countertops and backsplash in a manner that will prevent damage and disfigurement.

1.4 DESIGN

Provide factory fabricated, prefinished plastic laminate countertops in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Construct countertops as specified and meet the requirements of KCMA A161.1. Accomplish fastenings to permit removal and replacement of individual units without affecting the remainder of the installation. Provide counters with watertight sink rim when indicated. Include removable drawers equipped with position stops to avoid accidental complete withdrawals.

PART 2 PRODUCTS

2.1 GENERAL

Submit Manufacturer's Standard Color Charts for countertops showing the manufacturer's recommended color and finish selections.

Submit Manufacturer's Instructions for countertops including special provisions required to install equipment components and system packages. Include all special notices detailing impedances, hazards and safety precautions.

Provide the manufacturer's standard type countertops or as indicated on the drawings. Accomplish fastenings to permit removal and replacement of individual countertops without affecting the remainder of the installation.

2.2 MATERIALS

Provide Corrosion-Resistant Steel conforming to ASTM A1008/A1008M and ASTM A167, Type 304 Finish 4.

Use thermosetting urea-resin Type II Adhesives for application of plastic laminate conforming to ASTM D 4690 as recommended by the manufacturer of the laminate. Use adhesive for wood members conforming to ASTM D 4689.

Use Filler Material conforming to FS TT-F-336.
Provide Plastic Laminate conforming to ANSI/NEMA LD 3, Style as indicated on drawings.

Provide fasteners conforming to the following:

Screws: ASME B18.6.1, Group, Type and Class as applicable

Anchoring Devices: FS FF-S-325, Group, Type, and Class as applicable

Toggle bolts: FS FF-B-588, Type I, Class A, Style 2

Nuts: ASTM F 594, corrosion-resistant steel

Bolts: ASTM A325, heavy, hexagon head bolts corrosion-resistant steel

Nuts: ASTM F 836M, corrosion-resistant steel

Bolts: ASTM A325M, heavy, hexagon head bolts corrosion-resistant steel

Corrosion-resistant Steel Sinks:

18-gage corrosion-resistant steel, nonintegral, self-rimming

Drain holes in center of bowl

Underside coated with 1/8-inch thick sound deadener

Die-form, seamless, raised edges at front and ends

Cove corners to 1/2-inch radius

Equip with strainers and tail pieces

Sound deadening: conform to FS TT-C-520.

Provide Service Fixtures conforming to the following requirements:

Fixtures: In accordance with the water conservation policy as stated in the Standard Plumbing Codes, Appendix J.

Faucets: Splashback mounted, cast brass, chrome plated, FS WW-P-541

Faucets: Deck mounted, cast brass, chrome plated, FS WW-P-541

Drains, strainers, and taps: Brass, chrome plated, FS WW-P-541

Index buttons: Plastic, color codes in accordance with SEFA 7

Special items: Nipples and locknuts with each fixture will be as directed.

Metal pretreatment coatings: FS TT-C-490, Type I

2.3 COUNTERTOP AND BACKSPLASH FABRICATION

Construct countertops and backsplash of wood covered with a shop-applied plastic laminate.

Specify particle board with a minimum thickness of 3/4 inch. Build up edges and opening around sink rim with hardwood strips. Provide backsplash of similar construction, a minimum of 3/4-inch thick by the height indicated.

Provide continuous sheet laminate of the longest length practicable and of the design and color selected. Provide joints in the surface sheeting that are tight and flush, and held to a practical minimum number.

Edging and trim:

For plastic-laminate-covered countertops and backsplash, provide edging and trim consisting of:

Strips of laminate cut and fitted to exposed edges with contact adhesive

Provide sink rims which are the standard products of a manufacturer regularly producing this type of equipment, fabricated from corrosion-resistant steel of the size necessary to receive the sinks.

2.3.1 High-Pressure Laminated Plastic Clad Countertops

Construct clad countertop and backsplash of 3/4 inch thick, 44 pound density particle board core, post formed cove type or fully formed type. Provide single unit cove type unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash. Provide edging and trim that consists of plastic laminate cut and fitted to all exposed edges. Supply end splashes constructed of 3/4 inch plywood or 3/4 inch thick, 44 pound density particle board core. Provide continuous sheets of longest lengths practicable. Make all joints in surface sheeting tight and flush. When the countertop and backsplash are two separate units, use GP50 plastic laminate. When the countertop and backsplash are one unit, use PF42 plastic laminate. Provide plastic laminate conforming to the requirements of ANSI/NEMA LD 3, with contact type plastic laminate adhesive applied to both surfaces. For fully formed and cove type countertops, the post-forming plastic laminate can not be bent to a radius smaller than the limit recommended by the plastic manufacturer.

2.4 SURFACING

2.4.1 Laminated Plastic Surfacing

Laminate plastic sheeting to faces and exposed edges of particle board at 20 pounds per square inch and 185 degrees F.

Apply backing sheet to concealed faces.

2.4.2 Wood Countertop Finish

Provide factory applied HPDL finish as indicated on all internal and external surfaces.

2.4.2.1 HPDL Finish

Pattern and color: As selected from manufacturer's standard finishes As indicated.

2.5 ACCESSORIES AND HARDWARE

2.5.1 Mounting Adhesives

Provide structural-grade silicone or epoxy adhesives of type recommended by manufacturer for application and conditions of use.

Provide spacers, if required, of type recommended by adhesive manufacturer.

2.5.2 Joint Sealants

Use clear silicone sealant of type recommended by manufacturer for application and conditions of use.

Provide anti-bacterial type in food preparation areas.

2.5.3 Solvent

Use a product recommended by adhesive manufacturer to clean surface of quartz surfacing to assure adhesion of adhesives and sealants.

2.5.4 Cleaning Agents

Use non-abrasive, soft-scrub type kitchen cleaners.

2.6 COLOR, TEXTURE, AND PATTERN

Select color as indicated on the drawings. from manufacturers standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

Inspect material for defects prior to installation. Ensure materials throughout bear labels with the same batch number. Visually inspect materials used for adjacent pieces to assure acceptable color match. Inspect in lighting conditions similar to those on the project. Repair or replace damaged materials in a satisfactory manner.

Install countertops plumb with cabinetry level to within 1/16 inch in 10 feet. Level base cabinets by adjusting leveling screws. Scribe and fit scribe strips to irregularities of adjacent surfaces. Gap openings exceeding 0.025 inch are not acceptable.

Secure countertops to cabinetry and wall construction usingscrews, spaced 30 inches maximum on center.

3.1.1 Preliminary Installation and Adjustment

Install materials in accordance to manufacturer's recommendations. Lift and place to avoid breakage.

Position materials to verify that materials are correctly sized and prepared. Make necessary adjustments.

If jobsite cutting, grinding, or polishing is required, use water-cooled tools. Protect jobsite and surfaces against dust and water. Perform work away from installation site if possible.

3.1.2 Permanent Installation

After verifying fit, remove quartz surfacing from position, clean substrates of dust and contamination, and clean quartz surfacing back side and joints with solvent.

Apply sufficient quantity of mounting adhesive in accordance with adhesive manufacturer's recommendations to provide permanent, secure installation.

Spacing of mounting adhesive will not exceed:

Horizontal Surfaces: 16 inch on center

Vertical Surfaces: 8 inch on center; provide temporary shims until adhesive cures.

Install surfacing plumb, level, and square and flat to within 1/6 inch in 10 feet.

3.1.3 Joints

Joints between adjacent pieces of quartz surfacing:

Joints must be flush, tight fitting, level, and neat.

Securely join with stone adhesive. Fill joints level with quartz surfacing.

Clamp or brace quartz surfacing in position until adhesive sets.

Joints between backsplashes and countertops: Seal joints with silicone sealer.

3.2 CLEANING

On completion of cabinet installation, touch up marred or abraded finished surfaces. Remove crating and packing materials from premises. Wipe down surfaces to remove fingerprints and markings and leave in clean condition.

3.3 INSPECTION

Examine casework grounds and supports for adequate anchorage, foreign material, moisture, and unevenness that could prevent quality casework installation.

Ensure that electrical and plumbing rough-ins for casework are complete. Do not proceed with installation until defects are corrected.

-- End of Section --

SECTION 21 13 13.00 10

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.1	(2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250
ASME B16.11	(2009) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(2010) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2006) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	(2010) Standard for Square and Hex Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A135/A135M	(2009) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A449	(2010) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A795/A795M	(2008) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM F 436	(2011) Hardened Steel Washers

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2010; Errata 10-1; TIA 10-1; TIA 11-2) Standard for the Installation of Sprinkler Systems
NFPA 1963	(2009; Errata 09-1) Standard for Fire Hose Connections
NFPA 20	(2010; TIA 10-1) Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	(2010) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2011) Building Materials Directory
UL Fire Prot Dir	(2011) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Furnish piping offsets, fittings, and any other accessories as required to provide a complete installation and to eliminate interference with other construction. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage. Provide wet pipe sprinkler system in all areas of the building. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Rack sprinklers shall be in accordance with NFPA 13. Design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the

sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

Hydraulically design the system to discharge a minimum density as shown on the drawings. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 20 ft/s.

1.2.1.1 Hose Demand

Add an allowance for exterior hose streams, as indicated on the drawings, to the sprinkler system demand at the point of connection to the existing system.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 55 psi, and a flow of 1300 gpm at a residual pressure of 28 psi based on a flow test conducted by Poole Fire Protection 9.11.11. The design shall also incorporate the use of a fire pump as specified in 21 30 00 FIRE PUMPS. Water supply shall be presumed available at the connection to the underground. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping. Hydraulic calculations shall be based on operation of the fire pump(s) provided in Section 21 30 00 FIRE PUMPS

1.2.1.3 Hydraulic Calculations

Submit hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments and as outlined in NFPA 13, except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings to substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13, but shall not exceed 100 square feet for extra hazard occupancies, 130 square feet for ordinary hazard occupancies, and 225 square feet for light hazard occupancies.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;
As-Built Drawings

SD-03 Product Data

Fire Protection Related Submittals
Materials and Equipment;
Spare Parts
Preliminary Tests;
Final Acceptance Test;
Onsite Training;
Fire Protection Specialist;
Sprinkler System Installer;

SD-05 Design Data

Hydraulic Calculations;

SD-06 Test Reports

Preliminary Test Report;
Final Acceptance Test Report;

SD-07 Certificates

Inspection by Fire Protection Specialist;

SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals

1.4 QUALITY ASSURANCE

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall

govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.4.1 Fire Protection Specialist

All required shop drawings, calculations, materials, qualifications, test procedures, and test reports shall be submitted to and approved by the Fire Protection Specialist. All final system acceptance testing shall be witnessed and approved by the Fire Protection Specialist. Submit the name and documentation of certification of the proposed Fire Protection Specialists prior to the submittal of the sprinkler system drawings and hydraulic calculations. The Fire Protection Specialist shall prepare and submit a list of the fire protection related submittals. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. The Fire Protection Specialist shall be a registered fire protection engineer in the State of Georgia.

1.4.2 Sprinkler System Installer

Work specified in this section shall be performed by the Sprinkler System Installer who is regularly engaged in the installation of the type and complexity of system specified in the contract documents, and who has served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. Submit the name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

1.4.3 Shop Drawings

Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Submit 3 copies of the Sprinkler System shop drawings, no later than 21 days prior to the start of sprinkler system installation. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall

show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. Submit load calculations for sizing of sway bracing, for systems that are required to be protected against damage from earthquakes.

1.5 DELIVERY, STORAGE, AND HANDLING

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.6 NOT USED

PART 2PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Provide Materials and Equipment that have been tested by Underwriters Laboratories, Inc. and are listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM APP GUIDE. Submit manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, provide a complete equipment list that includes equipment description, model number and quantity.

2.4 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

2.4.1 Steel Piping Components

2.4.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black for piping in interior spaces and galvanized for exterior spaces as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A795/A795M, ASTM A53/A53M, or ASTM A135/A135M. Pipe in which threads or grooves are cut or rolled formed shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut or rolled formed. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.4.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.4.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer;segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A47/A47M, Grade 32510; ductile iron conforming to ASTM A536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.

2.4.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type.

2.4.1.5 Bolts, Nut, and Washers

Bolts shall be conform to ASTM A449, Type 1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts, or as specified by the fitting manufacturer.

2.4.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM APP GUIDE and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.4.3 Valves

2.4.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type unless otherwise indicated on the design drawings. All control valves shall be listed in UL Bld Mat Dir or FM APP GUIDE.

2.4.3.2 Check Valve

Check valve 2 inches and larger shall be listed in UL Bld Mat Dir or FM APP GUIDE. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.5 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

2.6 ALARM INITIATING AND SUPERVISORY DEVICES

2.6.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.6.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.7 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. If used, female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963. Contractor shall coordinate fire department connection specifications with the owner.

2.8 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be ordinary unless otherwise required by NFPA 13. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used unless otherwise indicated.

2.8.1 Concealed Sprinkler

Concealed sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.8.2 Recessed Sprinkler

Recessed sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice. Recessed sprinkler shall be provided in the MSD portion of the building.

2.8.3 Flush Sprinkler

Flush sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.8.4 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, quick-response type (where permitted by NFPA 13) with nominal 1/2 inchor 17/32 inch orifice. Pendent sprinklers shall have a polished chrome finish.

2.8.5 Upright Sprinkler

Upright sprinkler shall be chrome-plated and shall have a nominal 1/2 inch or 17/32 inch orifice. Upright sprinklers shall be quick response where permitted by NFPA 13.

2.8.6 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.

2.8.7 Corrosion Resistant Sprinkler

Corrosion resistant sprinkler shall be the upright or pendent type installed in corrosive environments. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.

2.8.8 Dry Sprinkler Assembly

Dry sprinkler assembly shall be of the sidewall, type and listed for extended coverage use in ordinary hazard occupancies. Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in UL Fire Prot Dir. Sprinklers shall have a polished chrome finish.

2.9 ACCESSORIES

2.9.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.9.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.9.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.9.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers susceptible to mechanical damage. Examples include, but are not limited to, mechanical rooms, elevator pits, high traffic areas, and other areas subject to mechanical impact.

2.9.5 Identification Sign

Valve identification sign shall be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

A hydraulic data placard shall be located at each riser. The placard shall be a permanently marked, weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire or chain. The placard shall contain the following information:

a. Location of design area or areas

b. Discharge densities over the design area or areas

c. Required flow and residual pressure demand at the base of the riser

d. Occupancy classification or commodity classification and maximum permitted storage heigh and configuration

e. Hose stream allowance included in addition to the sprinkler demand

f. The name of the installing contractor

PART 3 EXECUTION

3.1 FIELD MEASUREMENTS

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 13.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

Prior to ceiling installation and concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports. The Fire Protection Specialist shall: 1) inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements, 2) witness the preliminary and final tests, and sign the test results, 3) after completion of the system inspections and a successful final test, certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

Seismically protect the system piping against damage from earthquakes in accordance with NFPA 13.

3.4.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide a minimum headroom of 7'-6".

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches for steel pipe or 6 inches for copper tubing. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the

reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area. Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation.

Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07 84 00 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected at the riser as a combination test and drain valve; a test valve located a maximum of 6 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. All other drain piping shall be piped outside of the building unless otherwise indicated in the design documents. Auxiliary drains shall be provided as required by NFPA 13 and the design documents.

3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade and as shown on the drawings. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Wiring color code shall remain uniform throughout the system.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.7 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. Submit proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests and proposed date and time to begin the preliminary tests. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, submit 3 copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Tests. The Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

3.7.1 Underground Piping

3.7.1.1 Flushing

Existing underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system.

3.7.2 Aboveground Piping

3.7.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.7.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. Provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, pitot tube gauge, plus all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. Provide a metal placard on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.7.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.7.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.8 FINAL ACCEPTANCE TEST

Begin the Final Acceptance Test only when the Preliminary Test Report has been approved. Submit proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests, and proposed date and time to begin the Test, submitted with the procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Submit as-built shop drawings, at least 14 days after completion of the Final Tests, updated to reflect as-built conditions after all related work is completed. Drawings shall be in electronic format. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. Submit 2 copies of the completed Final Acceptance Test Report no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

3.9 ONSITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 1010	(2002) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4	(1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)
ASSE 1010	(2004) Performance Requirements for Water Hammer Arresters (ANSI approved 2004)
ASSE 1018	(2001) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002
ASSE 1019	(2011) Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type (ANSI Approved 2004)
ASSE 1037	(1990) Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites

AWWA B301	(2010) Liquid Chlorine
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(2011) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C652	(2011) Disinfection of Water-Storage Facilities

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2011) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.2/B2.2M	(2010) Specification for Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.14.1	(2003; R 2008) Backwater Valves
ASME A112.19.2/CSA B45.1	(2008; Update 1 2009; Update 2 2011) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
ASME A112.19.3/CSA B45.4	(2008; Update 1 2009; Update 2 2011) Stainless Steel Plumbing Fixtures
ASME A112.36.2M	(1991; R 2008) Cleanouts
ASME A112.6.1M	(1997; R 2008) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2001; R 2007) Standard for Floor and Trench Drains
ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B16.12	(2009) Cast Iron Threaded Drainage Fittings
ASME B16.15	(2011) Cast Bronze Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22	(2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2007) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.50	(2001; R 2008) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME B31.1	(2010) Power Piping
ASME B31.5	(2010) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2010) BPVC Section IV-Rules for Construction of Heating Boilers
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME CSD-1	(2009) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2011) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts

ASTM A193/A193M	(2011) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A515/A515M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A518/A518M	(1999; R 2008) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A733	(2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A74	(2009) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A888	(2011) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B152/B152M	(2009) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B306	(2009) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes

ASTM B43	(2009) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B584	(2011) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B75	(2002; R 2010) Standard Specification for Seamless Copper Tube
ASTM B813	(2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B828	(2002; R 2010) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2005; R 2011) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C1053	(2000; R 2010) Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C564	(2011) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2235	(2004; R 2011) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2239	(2003) Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2004; R 2009e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2661	(2011) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40, Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2665	(2011) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2672	(1996a; R 2009) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D2683	(2010) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2737	(2003) Polyethylene (PE) Plastic Tubing
ASTM D2822/D2822M	(2005e1; R 2011) Asphalt Roof Cement
ASTM D2846/D2846M	(2009be1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2855	(1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D2996	(2001; R 2007e1) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3035	(2010) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3122	(1995; R 2009) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D3138	(2004; R 2011) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3261	(2010a) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM E1	(2007) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM F 1760	(2001; R 2011) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 2389	(2010) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
ASTM F 409	(2002; R 2008) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(2009) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(2009) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(2011) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(2010) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2008) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core

ASTM F 877	(2011a) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F 891	(2010) Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2009) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(1994; R 1995) Copper Tube Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO PS 117	(2005b) Press Type Or Plain End Rub Gasketed W/ Nail CU & CU Alloy Fittings 4 Install On CU Tubing

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(2009) International Plumbing Code
ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(2010; Errata 2011) Steel Pipeline Flanges
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2002a) Butterfly Valves
MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MSS SP-70	(2006) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(2010) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(2005a) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2006) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-85	(2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE SP0169	(1992; R 2007) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2009) Motors and Generators
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF/ANSI 14	(2011a) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2011) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2010) Firestopping: Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(2010) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508 (2009) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SM 9223 (2004) Enzyme Substrate Coliform Test

PL 93-523 (1974; A 1999) Safe Drinking Water Act

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED (2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 141.80 National Primary Drinking Water Regulations; Control of Lead and Copper; General Requirements

PL 109-58 Energy Policy Act of 2005 (EPAct05)

UNDERWRITERS LABORATORIES (UL)

UL 1951 (2011) Electric Plumbing Accessories

UL 499 (2005; Reprint Mar 2011) Electric Heating Appliances

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 - SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System;

Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-03 Product Data

Fixtures

Flush valve water closets

Flush valve urinals

Wall hung lavatories

Kitchen sinks

Utility sinks

Floor sinks

Drinking-water coolers

Water heaters

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies;

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests.

SD-10 Operation and Maintenance Data

Plumbing System

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000

hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.3 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.4 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.3.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - IP

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system.

1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. PVC pipe shall contain a minimum of 25 percent recycled content in accordance with ASTM F 1760. HDPE pipe shall contain a minimum of 100 percent post-consumer recycled content. Steel pipe shall contain a minimum of 25 percent recycled content, with a minimum of 16 percent post-consumer recycled content. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F 2389. Polypropylene piping

that will be exposed to UV light shall be provided with a Factory applied UV resistant coating. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310

b. Coupling for Steel Pipe: AWWA C606.

c. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12).

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

g. Solder Material: Solder metal shall conform to ASTM B32.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.

k. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 230 degrees F.

l. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F 477.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138.

o. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D2235.

p. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.

q. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

r. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

s. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D3122.

t. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

u. Copper tubing shall conform to ASTM B88, Type K, L or M.

v. Heat-fusion joints for polypropylene piping: ASTM F 2389.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201. Water hammer arrester shall be piston type.

b. Copper, Sheet and Strip for Building Construction: ASTM B370.

c. Asphalt Roof Cement: ASTM D2822/D2822M.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

l. Thermometers: ASTM E1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110

Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Wall Hydrants (Frostproof)

ASSE 1019 with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

2.3.4 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve.The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets.The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.5 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1. Vitreous China, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with

appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains shall be copper alloy with all visible surfaces chrome plated. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature.

2.4.1 Automatic Controls

Provide automatic, sensor operated faucets and flush valves to comply with ASSE 1037 and UL 1951 for lavatory faucets, urinals, and water closets. Flushing and faucet systems shall consist of solenoid-activated valves with light beam sensors. Flush valve for water closet shall include an override pushbutton. Flushing devices shall be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

2.4.2 Flush Valve Water Closets

ASME A112.19.2/CSA B45.1, white vitreous china, siphon jet, elongated bowl, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 14 to 15 inches, except 17 to 19 inches for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Provide white solid plastic elongated open-front seat.

Water flushing volume of the water closet and flush valve combination shall not exceed1.28 gallons per flush.

Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Mounted height of flush valve shall not interfere with the hand rail in ADA stalls. Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.

2.4.3 Flush Valve Urinals

ASME A112.19.2/CSA B45.1, white vitreous china, wall-mounted, wall outlet, siphon jet, integral trap, and extended side shields. Provide urinal with the rim 17 inches above the floor. Water flushing volume of the urinal and flush valve combination shall not exceed 0.125 gallons per flush. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.

2.4.4 Wall Hung Lavatories

ASME A112.19.2/CSA B45.1, white vitreous china, straight back type, minimum dimensions of 19 inches, wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory. Mount lavatory with the front rim 34 inches above floor and with 29 inches minimum clearance from bottom of the front rim to floor. Provide top mounted washerless centerset lavatory faucets. Provide top-mounted solenoid-activated lavatory faucets including electrical-operated light-beam-sensor to energize the solenoid.

2.4.5 Kitchen Sinks

ASME A112.19.3/CSA B45.4, 20 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of 33 inches wide by 21 inches front to rear, two compartments, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 3.5 inch drain outlet. Provide aerator with faucet. Water flow rate shall not exceed 1.0 gpm when measured at a flowing water pressure of 60 psi. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 1.5 inch P-trap and drain piping to vertical vent piping from each compartment. Provide top mounted washerless sink faucets with hose spray.

2.4.6 Utility Sinks

ASME A112.19.2/CSA B45.1, white vitreous china with integral back and wall hanger supports, minimum dimensions of 22 inches wide by 20 inches front to rear, with two supply openings in 10 inch high back. Provide floor supported wall outlet cast iron P-trap and stainless steel rim guards as recommended by service sink manufacturer. Provide back mounted washerless service sink faucets with vacuum breaker and 0.75 inch external hose threads.

2.4.7 Drinking-Water Coolers

AHRI 1010 with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bubbler style, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor and basin, and stainless steel cabinet. Bubblers shall be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts shall be mounted at maximum of 36 inches above floor and at front of unit basin. Spouts shall direct water flow at least 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit. Provide ASME A112.6.1M concealed steel pipe chair carriers.

2.4.8 Wheelchair Drinking Water cooler

AHRI 1010, wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with 27 inch minimum knee clearance from front bottom of unit to floor and 36 inch maximum spout height above floor. Bubblers shall also be controlled by push levers, by

push bars, or touch pads one on each side or one on front and both sides of the cabinet.

2.5 DRAINS

2.5.1 Floor Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping. Primer shall meet ASSE 1018.

2.5.1.1 Drains and Backwater Valves

Drains and backwater valves installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.5.2 Floor Sinks

Floor sinks shall be square, with 12 inch nominal overall width or diameter and 10 inch nominal overall depth. Floor sink shall have an acid-resistant enamel interior finish with cast-iron body, aluminum sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size shall be as indicated or of the same size as the connecting pipe.

2.6 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The

assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.7 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 200 degrees F water temperature and 150 psi working pressure. The expansion tank size and acceptance volume shall be sized by the manufacturer.

2.7.1 Electric Instantaneous Water Heaters (Tankless)

UL 499 and UL listed flow switch activated, tankless electric instantaneous water heater for wall mounting below sink or lavatory.

2.8 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.9 MISCELLANEOUS PIPING ITEMS

2.9.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.9.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

2.9.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.9.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.9.3 Pipe Hangers (Supports)

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.9.4 Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using

crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.6 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise

location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Rigid grooved pipe couplings shall be for use with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 125 psi service and appropriate for static head plus the pumping head, and shall provide a watertight joint.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.1.2.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.2.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.6 Copper Tube and Pipe

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper- phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.

c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

d. Press connection. Copper press connections shall be made in **strict** accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer **of that joint**. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

3.1.2.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.2.8 Polypropylene Pipe

Joints for polypropylene pipe and fittings shall be made by heat fusion welding socket-type or butt-fusion type fittings and shall comply with ASTM F 2389.

3.1.2.9 Other Joint Methods

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be in accordance with industry standard. Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt

around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs,

flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve.The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.5.6 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.7.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 4 inches.

(2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in

determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 4 inches and larger carrying medium less that 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.7.3 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged

branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair

carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.4.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.4.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.4.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified inDIVISION 05 - METALS.

3.4 IDENTIFICATION SYSTEMS

3.4.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.4.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in DIVISION 09 - FINISHES.

3.4.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as directed by the Contracting Officer.

3.5 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.6 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in DIVISION 09 - FINISHES.

3.6.1 Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.6.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.6.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

3.7 TESTS, FLUSHING AND DISINFECTION

3.7.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.7.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.7.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.7.3 System Flushing

3.7.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with hot potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

3.7.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced.After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.7.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Temperature of each domestic hot-water supply.

f. Operation of each floor and roof drain by flooding with water.

g. Operation of each vacuum breaker and backflow preventer.

h. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

3.7.5 Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take addition samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with EPA SM 9223. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.8 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

3.9 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.10 TABLES

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X	

3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A536 And ASTM A47/A47M	X	X		X	X	
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M for use with Item 5	X	X		X	X	
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 5	X	X		X	X	
8	Wrought copper grooved joint pressure pressure fittings for non-ferrous pipe ASTM B75M ASTM B75 C12200, ASTM B152/B152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X				
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
10	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S, Grade B	X			X	X	

11	Seamless red brass pipe, ASTM B43				X	X	
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
13	Cast copper alloy solder joint pressure fittings, ASME B16.18for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B42						X
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D2661, ASTM F 628	X	X	X	X	X	X
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X	X	X
21	Process glass pipe and fittings, ASTM C1053						X

22	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A518/A518M		X			X	X
23	Polypropylene (PP) waste pipe and fittings, ASTM D4101						X
24	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D2996						X

SERVICE:
- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- * - Hard Temper

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	
4	Steel pipe:				

	a. Seamless, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings groovedjoint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter	X			X
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D3035	X			X

15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441/F 441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442/F 442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F 437, for use with Items 20, and 21	X	X		X
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 20, 21, and 22	X	X		X

25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D1785	X			X
26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2467 for use with Items 26 and 27	X			X
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2464	X			X
30	Joints for IPS PVC pipe using solvent cement, ASTM D2672	X			X
31	Polypropylene (PP) plastic pipe and fittings; ASTM F 2389	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F 877	X	X		X

38	Press Fittings: A - Cold Water Service Aboveground B - Hot and Cold Water Distribution 82 degrees C 180 degrees F Maximum Aboveground C - Compressed Air Lubricated D - Cold Water Service Belowground Indicated types are minimum wall thicknesses. ** - Type L - Hard *** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors **** - In or under slab floors only brazed joints

-- End of Section --

SECTION 22 07 19.00 40

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 209	(2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1136	(2006) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 195	(2000) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C 553	(2002) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 795	(2003) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(2003a) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 579	(2004) Standard Specification for Greige Woven Glass Fabrics
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 96/E 96M	(2005) Standard Test Methods for Water Vapor Transmission of Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(2006) Standard on Types of Building Construction
NFPA 255	(2005; Errata 2006) Standard Method of Test of Surface Burning Characteristics of Building Materials

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3779	(1990; Rev A; R 1994) Tape Adhesive, Pressure Sensitive Thermal Radiation Resistant, Aluminum Foil/Glass Cloth

1.2 SYSTEM DESCRIPTION

Section 23 00 00.00 40 HEATING, VENTILATING, AND AIR-CONDITIONING applies to work specified in this section.

1.3 PERFORMANCE REQUIREMENTS

Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, shall have a flame-spread classification (FSC) of 25, and a smoke-developed classification (SDC) of 50. These maximum values shall be determined in accordance with ASTM E 84 or NFPA 255. Coatings and sealants shall be nonflammable in their wet state.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Adhesives
Coatings
Insulation Materials
Jacketing

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry

state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 Cloth Adhesives

Adhesives for adhering, sizing, and finishing lagging cloth, canvas, and open-weave glass cloth shall be a pigmented polyvinyl acetate emulsion and shall conform to the requirements of ASTM C 916, Type I.

2.1.1.2 Vapor-Barrier Material Adhesives

Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be solvent-base, synthetic-rubber type and shall conform to the requirements of ASTM C 916, Type I, for attaching fibrous-glass insulation to metal surfaces. Solvent shall be nonflammable.

2.1.1.3 Cellular Elastomer Insulation Adhesive

Adhesive for cellular elastomer insulation shall be a solvent cutback chloroprene elastomer conforming to ASTM C 916, Type I, and shall be of a type approved by the manufacturer of the cellular elastomer for the intended use.

2.1.2 Coatings

2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be a nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to the requirements of ASTM C 1136 and ASTM C 921.

2.1.2.2 Indoor Vapor-Barrier Finishing

Coatings for indoor vapor-barrier finishing of insulation surfaces shall be a pigmented resin and solvent compound and shall conform to ASTM C 1136, Type II.

2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer-emulsion type recommended by the insulation material manufacturer for the surface to be coated and shall be applied to specified dry-film thickness.

2.1.2.4 Cellular-Elastomer Insulation Coating

Finish coating for cellular-elastomer insulation shall be a polyvinylchloride lacquer approved by the manufacturer of the cellular elastomer.

2.1.2.5 Coating Color

Coating color shall be as specified by the Contracting Officer's Technical Representative.

2.1.3 Insulating Cement

2.1.3.1 General Purpose Insulating Cement

General purpose insulating cement shall be mineral fiber and shall conform to ASTM C 195. Composite shall be rated for 1800 degrees F service and shall have a thermal-conductivity maximum of 0.85<MET> [_____] watt per meter per degree Kelvin</MET> Btu by inch per hour per square foot for each degree F temperature differential at 200 degrees F mean temperature for 1 inch thickness.

2.1.3.2 Finishing Insulating Cement

Finishing insulating cement shall be mineral-fiber, hydraulic-setting type conforming to ASTM C 449/C 449M.

2.1.4 Calking

Calking used with specified insulation materials shall be an elastomeric joint sealant in accordance with ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.5 Corner Angles

Corner angle piping insulation shall be nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be in accordance with ASTM B 209, Alloy 3105.

2.1.6 Insulation Materials

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

2.1.6.1 Mineral Fiber

Mineral fiber shall conform to ASTM C 553,
shall be suitable for surface temperatures up to 370 degrees F, and shall be of not less than 4-pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot square per degree F at 150 degrees F mean.

2.1.6.2 Pipe Barrel

Pipe barrel insulation shall be Type II, Molded, Grade A or Type III, Precision V-Groove, Grade A for use at temperatures up to and including 1200 degrees F.

2.1.6.3 Pipe Fittings

Pipe fitting insulation shall be molded pipe fitting covering for use at temperatures up to and including 1200 degrees F.

2.1.6.4 Flexible Blankets

Flexible blankets shall be blankets and felts for use at temperatures up to and including 350 degrees F minimum 1 pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot per degree F at 75 degrees F mean.

2.1.6.5 Cellular Glass

Cellular glass shall conform to ASTM C 552, Type II, Grade 2, pipe covering. Substitutions for this material shall not be permitted. Minimum thickness shall be 1-1/2 inches

2.1.7 Jacketing

2.1.7.1 Glass Cloth Jackets

Glass cloth shall be plain-weave glass cloth conforming to ASTM D 579, Style 141 and shall weigh not less than 7.23 ounces per square yard before sizing. Cloth shall be factory applied wherever possible.

Glass reinforcing cloth shall be a leno weave, 26-end and 12-pick thread conservation, with a warp and fill tensile strength of 45 and 30 pounds per inch of width, respectively, and with a weight of not less than 1.5 ounces per square yard.

2.1.7.2 PVC Jackets

Polyvinylchloride (PVC) shall be a 0.010 inch thick, factory-premolded, pipe-barrel sheeting vapor-barrier jacketing. Material shall be self-extinguishing, high-impact strength, moderate chemical resistance. Permeability rating shall be 0.01 grain per hour per square foot per inch of mercury pressure difference, determined in accordance with ASTM E 96/E 96M. Vapor-barrier joint adhesive shall be the manufacturer's standard solvent-weld type.

Vapor barrier shall conform to ASTM C 1136, Type I, low-vapor transmission, high-puncture resistance for use on insulation for piping, ducts, and equipment.

2.1.7.3 3-Ply Laminate

Jacketing shall be a 3-ply laminate of 35-pound per 100 square foot white-bleached kraft, bonded to not less than 0.0007 inch thick aluminum foil and reinforced with glass fiber.

Water-vapor permeance rating of the composite shall be 0.02 perm or grain per hour per square foot, per inch of mercury pressure differential, determined in accordance with ASTM E 96/E 96M.

2.1.8 Tape

Glass lagging shall be a knitted elastic cloth specifically suitable for continuous spiral wrapping of insulated pipe bends and fittings and shall produce a smooth, tight, wrinkle-free surface. Tape shall conform to

requirements of SAE AMS 3779, SAE AMS 3779, ASTM D 579, and ASTM C 921, and shall weigh not less than 10 ounces per square yard.

2.2 PIPING SYSTEMS

Insulation thickness and pipe sizes are in inches. Pipe size is inclusive dimensionally, and includes pipe nominal pipe size (NPS) and tubing outside diameter.

2.2.1 Cold-Water and Condensate-Drain Piping

Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated

Insulation shall be 3/8 inch mineral fiber with glass cloth jacket, Type T-2.

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Joints shall be tight with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed, or finished as specified. Longitudinal seams of exposed insulation shall be directed away from normal view.

Materials shall be applied in conformance with the recommendations of the manufacturer.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

Installation Drawings for pipe insulation shall be in accordance with the adhesive manufacturer's written instructions for installation.

3.2 SYSTEM TYPES

3.2.1 Type T-1, Mineral Fiber with Vapor-Barrier Jacket

Piping shall be covered with mineral-fiber pipe insulation with factory-and field-attached vapor-barrier jacket. Vapor seal shall be maintained. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than 1-1/2 inches. Jacketing bands for butt joints shall be 3 inches wide.

Exposed-to-view fittings and valve bodies shall be covered with preformed mineral-fiber pipe-fitting insulation of the same thickness as the pipe-barrel insulation. Fitting insulation shall be temporarily secured in place

with light cord ties.A 60-mil coating of white indoor vapor-barrier coating shall be applied and, while still wet, wrapped with glass lagging tape with 50 percent overlap, and shall be smoothly blended into the adjacent jacketing. Additional coating shall be applied as needed and rubber-gloved to smooth fillet or contour coating, then allowed to fully cure before the finish coating is applied. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a special mastic consisting of a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Where standard vapor-barrier jacketing cannot be used, the surfaces shall be made vapor tight by using coating and glass lagging cloth or tape as previously specified.

In lieu of materials and methods previously specified, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. Seams shall be made vapor tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. All jacket ends shall be held in place with AISI 300 series corrosion-resistant steel straps, 15 mils thick by 1/2 inch wide.

Pipe insulation shall be set into an outdoor vapor-barrier coating for a minimum of 6 inches at maximum 12-foot spacing and the ends of the insulation sealed to the jacketing with the same material to provide an effective vapor-barrier stop.

Staples shall not be used in applying insulation. Vapor-barrier materials shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealments.

Piping insulation at hangers shall consist of 13-pounds per cubic foot density, fibrous-glass inserts or expanded, rigid, closed-cell, polyvinylchloride. Junctions shall be sealed with vapor-barrier jacket where required, glass-cloth mesh tape, and vapor-barrier coating.

White-bleached kraft paper side of the jacketing shall be on the side exposed to view.

Exposed-to-view insulation shall be finished with not less than a 6-mil dry-film thickness of nonvapor-barrier coating suitable for painting.

3.2.2 Type T-10, Mineral-Fiber Fill

Voids surrounding pipe shall be packed with mineral-fiber fill.

-- End of Section --

SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 201	(2002; R 2011) Fans and Systems
AMCA 210	(2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(2008) Reverberant Room Method for Sound Testing of Fans
AMCA 301	(2006; INT 2007; Errata 2008) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 260	(2001) Sound Rating of Ducted Air Moving and Conditioning Equipment
AHRI 350	(2008) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
AHRI 410	(2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI 430	(2009) Central-Station Air-Handling Units
AHRI 440	(2008) Room Fan-Coils and Unit Ventilators
AHRI 880	(2011) Performance Rating of Air Terminals
AHRI 885	(2011) Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
AHRI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11	(1990; R 2008) Load Ratings and Fatigue Life for Roller Bearings
ABMA 9	(1990; R 2008) Load Ratings and Fatigue Life for Ball Bearings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.2	(2007; Addenda B 2008; Errata 2009, Errata 2010; INT 2010; Errata 2011) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 62.1	(2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality
ASHRAE 68	(1997) Laboratory Method of Testing to Determine the Sound Power In a Duct
ASHRAE 70	(2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B766	(1986; R 2008) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C1071	(2005e1) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

ASTM C553	(2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM D1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D3359	(2009e2) Measuring Adhesion by Tape Test
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM E2016	(2006) Standard Specification for Industrial Woven Wire Cloth
ASTM E84	(2011b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F 1040	(1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2009) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code
NFPA 701	(2010) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1819	(2002) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 5th Edition
SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82	Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 181	(2005; Reprint Oct 2008) Factory-Made Air Ducts and Air Connectors
UL 1995	(2011) Heating and Cooling Equipment
UL 555	(2006; Reprint Sep 2011) Standard for Fire Dampers
UL 555S	(1999; Reprint May 2011) Smoke Dampers
UL 586	(2009) Standard for High-Efficiency Particulate, Air Filter Units
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 705	(2004; Reprint Apr 2011) Standard for Power Ventilators
UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
UL 900	(2004; Reprint Nov 2009) Standard for Air Filter Units
UL 94	(1996; Reprint Oct 2010) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL Bld Mat Dir	(2011) Building Materials Directory
UL Electrical Construction	(2011) Electrical Construction Equipment Directory
UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

1.2.1 Mechanical Equipment Identification

The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms. Where more than one chart or diagram per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.2.1.1 Charts

Provide chart listing of equipment by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics.

1.2.1.2 Diagrams

Submit proposed diagrams, at least 2 weeks prior to start of related testing. provide neat mechanical drawings provided with extruded aluminum frame under 1/8-inch glass or laminated plastic, system diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system. After approval, post these items where directed.

1.2.2 Service Labeling

Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation.

1.2.3 Color Coding

Color coding of all piping systems shall be in accordance with ASME A13.1.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Metallic Flexible Duct
Insulated Nonmetallic Flexible Duct Runouts
Duct Connectors
Duct Access Doors
Fire Dampers
Manual Balancing Dampers
Automatic Smoke Dampers
Diffusers
Registers and Grilles
Louvers
In-Line Centrifugal Fans
Sidewall Propeller Type Fans
Centrifugal Type Power Roof Ventilators
Air Handling Units
Room Fan-Coil Units
Variable Volume, Single Duct Terminal Units
Test Procedures
Diagrams

SD-06 Test Reports

Performance Tests

SD-07 Certificates

None

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions
Operation and Maintenance Training

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Fire Dampers
Automatic Smoke Dampers
In-Line Centrifugal Fan
Sidewall Propeller Type Fans
Centrifugal Type Power Roof Ventilators
Air Handling Units
Room Fan-Coil Units
Variable Volume, Single Duct Terminal Units

1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.

c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or

treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations. Provide written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. Include illustrations of product markings, and the number of each type of bolt to be furnished in the certification.

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 Ozone Depleting Substances Used as Refrigerants

Minimize releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F.

1.4.4 Use of Ozone Depleting Substances, Other than Refrigerants

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

a. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon

b. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays.

c. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial cabling.

d. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

1.4.5 Detail Drawings

Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of

the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

1.4.6 Test Procedures

Submit proposed test procedures and test schedules for the ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

2.2 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

2.3 ELECTRICAL WORK

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00INTERIOR DISTRIBUTION SYSTEM. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.

c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system , and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.

d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

e. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers are allowed to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and adjustable frequency drives for larger motors.

2.4 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

2.5 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

2.6 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

2.7 DUCT SYSTEMS

2.7.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification.

a. Ductwork shall be constructed meeting the requirements for the duct system static pressure specified in APPENDIX D of Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

b. Provide ductwork that meets the requirements of Seal Class A. Provide ductwork in VAV systems upstream of the VAV boxes that meets the requirements of Seal Class A.

c. Provide sealants that conform to fire hazard classification specified in DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.

2.7.1.1 Metallic Flexible Duct

a. Provide duct that conforms to UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Provide duct assembly that does not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of two inches water gauge positive and 1.5 inches water gauge negative. Provide flexible round duct length that does not exceed five feet. Secure connections by applying adhesive for two inches over rigid duct, apply flexible duct two inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.

b. Inner duct core: Provide interlocking spiral or helically corrugated flexible core constructed of zinc-coated steel, aluminum, or stainless steel; or constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.

c. Insulation: Provide inner duct core that is insulated with mineral fiber blanket type flexible insulation, minimum of one inch thick. Provide insulation covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

2.7.1.2 Insulated Nonmetallic Flexible Duct Runouts

Use flexible duct runouts only where indicated.Runout length is indicated on the drawings, and is not to exceed 5 feet. Provide runouts that are preinsulated, factory fabricated, and that comply with NFPA 90A and UL 181. Provide either field or factory applied vapor barrier. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts.Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

2.7.1.3 General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector

system that complies with NFPA 701 and is classified as "flame-retardent fabrics" in UL Bld Mat Dir.

2.7.2 Duct Access Doors

Provide hinged access doors conforming to SMACNA 1966 in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 15 by 18 inches, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 24 by 24 inches or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

2.7.3 Fire Dampers

Use 1.5 hour rated fire dampers unless otherwise indicated. Provide fire dampers that conform to the requirements of NFPA 90A and UL 555. Perform the fire damper test as outlined in NFPA 90A. Provide a pressure relief door upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then provide a factory installed pressure relief damper. Provide automatic operating fire dampers with a dynamic rating suitable for the maximum air velocity and pressure differential to which it is subjected. Provide fire dampers approved for the specific application, and install according to their listing. Equip fire dampers with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, does not impair the operation of the damper. Equip sleeves or frames with perimeter mounting angles attached on both sides of the wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies in conformance with UL Fire Resistance. Provide curtain type with damper blades out of the air stream or single blade type or multi-blade type fire dampers. Install dampers that do not reduce the duct or the air transfer opening cross-sectional area. Install dampers so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, comply with the installation details given in SMACNA 1819 and in manufacturer's instructions for fire dampers. Perform acceptance testing of fire dampers according to paragraph Fire Damper Acceptance Test and NFPA 90A.

2.7.4 Manual Balancing Dampers

a. Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators.

b. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide access doors or panels in hard ceilings, partitions and walls for access to all concealed damper operators and damper locking setscrews. Coordinate location of doors or panels with other affected contractors.

c. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.7.4.1 Square or Rectangular Dampers

a. Duct Height 12 inches and Less

(1) Frames:
Maximum 19 inches in width, maximum 12 inches in height; minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height; Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

(2) Single Leaf Blades:
Maximum 19 inches in width, maximum 12 inches in height; Minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height; Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

(3) Blade Axles:
To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

Maximum 19 inches in width, maximum 12 inches in height; Galvanized steel, minimum of 3/8 inch square shaft.

More than 19 inches in width, maximum 12 inches in height; Galvanized steel, minimum of 1/2 inch square shaft.

(4) Axle Bearings:
Support the shaft on each end at the frames with shaft bearings. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

Maximum 19 inches in width, maximum 12 inches in height; solid nylon, or equivalent solid plastic, or oil-impregnated bronze bearings.

More than19 inches in width, maximum 12 inches in height; oil-impregnated bronze bearings.

(5) Control Shaft/Hand Quadrant:
Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 50 mm 2 inches off the metal duct surface. Stand-off mounting items

shall be integral with the operator or standard accessory of the damper manufacturer.

(6) Finish: Mill Galvanized

b. Duct Height Greater than 12 inches

Provide dampers with multi-leaf opposed-type blades.

(1) Frames:
Maximum 48 inches in height; maximum48 inches in width; minimum of 16 gauge galvanized steel,
minimum of 5.5 inches long.

(2) Blades:
Minimum of 16 gauge galvanized steel; 6 inch nominal width.

(3) Blade Axles:
To support the blades of round dampers, provide galvanized square steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

(4) Axle Bearings:
Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

(5) Blade Actuator: Minimum 1/2 inch diameter galvanized steel.

(6) Blade Actuator Linkage: Mill Galvanized steel bar and crank plate with stainless steel pivots.

(7) Control Shaft/Hand Quadrant: Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 50 mm 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

(8) Finish: Mill Galvanized

2.7.4.2 Round Dampers

a. Frames:

4 to 20 inches size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

22 to 30 inches size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

32 to 40 inches size: Minimum of 16 gauge galvanized steel, minimum of 10 inches long.

b. Blades:

4 to 20 inches size: Minimum of 20 gauge galvanized steel

22 to 30 inches size: Minimum of 16 gauge galvanized steel

32 to 40 inches size: Minimum of 10 gauge galvanized steel

c. Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

4 to 20 inches size: Minimum of 3/8 inch square shaft.

22 to 30 inches size: Minimum of 1/2 inch square shaft.

32 to 40 inches size: Minimum of 3/4 inch square shaft.

d. Axle Bearings:

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

4 to 20 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

22 to 30 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

32 to 40 inches size: oil-impregnated bronze, or stainless steel sleeve bearing

e. Control Shaft/Hand Quadrant:

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

f. Finish: Mill Galvanized

2.7.5 Automatic Balancing Dampers

Provide dampers as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.7.6 Automatic Smoke Dampers

UL listed multiple blade type, supplied by smoke damper manufacturer, with pneumatic damper operator as part of assembly. Qualified under UL 555S with a leakage rating no higher than Class II or III at an elevated temperature Category B (250 degrees F for 30 minutes). Ensure that pressure drop in the damper open position does not exceed 0.1 inch water gauge with average duct velocities of 2500 fpm.

2.7.7 Diffusers, Registers, and Grilles

Provide factory-fabricated units of steel that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to ASHRAE 70.Provide sound rated and certified inlets and outlets according to ASHRAE 70.Provide sound power level as indicated. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers, except linear slot diffusers. Provide linear slot diffusers with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, protect them by a grille or screen according to NFPA 90A.

2.7.7.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Provide diffusers with air deflectors of the type indicated. Provide air handling troffers or combination light and ceiling diffusers conforming to the requirements of UL Electrical Construction for the interchangeable use as cooled or heated air supply diffusers or return air units. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

2.7.7.2 Registers and Grilles

Provide units that are four-way directional-control type, except provide return and exhaust registers that are fixed horizontal or vertical louver type similar in appearance to the supply register face. Furnish registers with sponge-rubber gasket between flanges and wall or ceiling. Install wall supply registers at least 6 inches below the ceiling unless otherwise indicated. Locate return and exhaust registers 6 inches above the floor unless otherwise indicated. Achieve four-way directional control by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Provide grilles as specified for registers, without volume control damper.

2.7.8 Louvers

Provide louvers for installation in exterior walls that are associated with the air supply and distribution system as specified in Section 08 91 00 METAL WALL LOUVERS.

2.7.9 Bird Screens and Frames

Provide bird screens that conform to ASTM E2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.8 AIR SYSTEMS EQUIPMENT

2.8.1 Fans

Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans shall not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 150 percent of the connected driving capacity. Provide variable pitch motor sheaves for 15 hp and below, and fixed pitch as defined by AHRI Guideline D (A fixed-pitch sheave is provided on both the fan shaft and the motor shaft. This is a non-adjustable speed drive.). Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to AMCA 300. Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to UL 705 and have a UL label.

2.8.1.1 In-Line Centrifugal Fans

Provide in-line fans with centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Mount fans in a welded tubular casing. Provide a fan that axially flows the air in and out. Streamline inlets with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Enclose and isolate fan bearings and drive shafts from the air stream. Provide precision, self aligning ball or roller type fan bearings that are sealed against dust and dirt and are permanently lubricated. Provide L50 rated bearing life at not less than 200,000 hours as defined by

ABMA 9 and ABMA 11. Provide motors with totally enclosed enclosure. Provide manual motor starters across-the-line with general-purpose enclosures.

2.8.1.2 Sidewall Propeller Type Fans

Provide propeller type fans, assembled on a reinforced metal panel with venturi opening spun into panel. Provide direct or V-belt driven fans with wheels less than 24 inches in diameter and provide V-belt driven fans with wheels 24 inches in diameter and larger. Provide fans with wall mounting collar. Provide lubricated bearings. Equip fans with wall housing kits. Provide totally enclosed fan cooled type motor enclosure. Install gravity backdraft dampers where indicated. Provide with accessories as indicates on the plans.

2.8.1.3 Centrifugal Type Power Roof Ventilators

Provide direct or V-belt driven centrifugal type fans with backward inclined, non-overloading wheel. Provide hinged or removable and weatherproof motor compartment housing, constructed of heavy gauge aluminum. Provide fans with birdscreen, disconnect switch as indicated, gravity dampers, and roof curb. Provide dripproof type motor enclosure. Use only lubricated bearings.

2.8.2 Coils

Provide fin-and-tube type coils constructed of seamless copper tubes and aluminum fins mechanically bonded or soldered to the tubes. Provide copper tube wall thickness that is a minimum of 0.016 inches. Provide aluminum fins that are 0.0055 inch minimum thickness. Provide casing and tube support sheets that are not lighter than 16 gauge galvanized steel, formed to provide structural strength.When required, provide multiple tube supports to prevent tube sag. Test each coil at the factory under water at not less than 400 psi air pressure and make suitable for 200 psi working pressure and 300 degrees F operating temperature unless otherwise stated. Mount coils for counterflow service. Rate and certify coils to meet the requirements of AHRI 410.

2.8.2.1 Electric Heating Coil

Provide an electric duct heater coil in accordance with UL 1995 and NFPA 70. Provide duct- or unit-mounted coil. Provide nickel chromium resistor, single stage, strip type coil. Provide coil with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized. Provide galvanized steel or aluminum coil casing and support brackets. Mount coil to eliminate noise from expansion and contraction and for complete accessibility for service.

2.8.3 Air Filters

List air filters according to requirements of UL 900, except list high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method under the Label Service to meet the requirements of UL 586.

2.8.3.1 Extended Surface Pleated Panel Filters

Provide 2 inch depth, sectional, disposable type filters of the size indicated with a MERV of 8 when tested according to ASHRAE 52.2. Provide

initial resistance at 500 fpm that does not exceed 0.36 inches water gauge. Provide UL Class 2 filters, and nonwoven cotton and synthetic fiber mat media. Attach a wire support grid bonded to the media to a moisture resistant fiberboard frame. Bond all four edges of the filter media to the inside of the frame to prevent air bypass and increase rigidity.

2.8.3.2 Extended Surface Nonsupported Pocket Filters

Provide 4 inch depth, sectional, replaceable dry media type filters of the size indicated with a MERV of 13 when tested according to ASHRAE 52.2. Provide initial resistance at 500 fpm that does not exceed 0.45 inches water gauge. Provide UL Class 1 filters. Provide fibrous glass media, supported in the air stream by a wire or non-woven synthetic backing and secured to a galvanized steel metal header. Provide pockets that do not sag or flap at anticipated air flows. Install each filter with an extended surface pleated panel filter as a prefilter in a factory preassembled, side access housing or a factory-made sectional frame bank, as indicated.

2.8.3.3 Cartridge Type Filters

Provide 12 inch depth, sectional, replaceable dry media type filters of the size indicated with a MERV of 13 when tested according to ASHRAE 52.2. Provide initial resistance at 500 fpm that does not exceed 0.56 inches, water gauge. Provide UL class 1 filters, and pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow have no effect on filter integrity or performance. Install each filter with an extended surface pleated media panel filter as a prefilter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.8.3.4 Holding Frames

Fabricate frames from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Equip each holding frame with suitable filter holding devices. Provide gasketed holding frame seats. Make all joints airtight.

2.8.3.5 Filter Gauges

Provide dial type filter gauges, diaphragm actuated draft for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, with white dials with black figures, and graduations with a minimum range of 1 inch of water beyond the specified final resistance for the filter bank on which each gauge is applied. Provide each gauge with a screw operated zero adjustment and two static pressure tips with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

2.9 AIR HANDLING UNITS

2.9.1 Field-Fabricated Air Handling Units

Provide built-up units as specified in paragraph DUCT SYSTEMS. Provide fans, coils spray-coil dehumidifiers, and air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types indicated.

2.9.2 Factory-Fabricated Air Handling Units

Provide single-zone draw-through type or single-zone blow-through type units as indicated. Units shall include fans, coils, airtight insulated casing, filter sections, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, mixing box, spray type humidifier, vibration-isolators, and appurtenances required for specified operation. Provide vibration isolators as indicated. Physical dimensions of each air handling unit shall be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling.

2.9.2.1 Casings

Provide the following:

a. Casing sections 2 inch double wall type as indicated, constructed of a minimum 18 gauge galvanized steel, or 18 gauge corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Inner casing of double-wall units that are a minimum 20 gauge solid galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.

b. Individually removable exterior panels with standard tools. Removal shall not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.

c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 18 gauge outer and 20 gauge inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be a minimum 24 inches wide, the full height of the unit casing or a minimum of 6 foot, whichever is less.

d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 16 gauge galvanized steel, conforming to ASHRAE 62.1. Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Coils shall be individually removable from the casing.

e. Casing insulation that conforms to NFPA 90A. Single-wall casing sections handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having

a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Double-wall casing sections handling conditioned air shall be insulated with not less than 2 inches of the same insulation specified for single-wall casings. Foil-faced insulation is not an acceptable substitute for use with double wall casing. Double wall insulation shall be completely sealed by inner and outer panels.

f. Factory applied fibrous glass insulation that conforms to ASTM C1071, except that the minimum thickness and density requirements do not apply, and that meets the requirements of NFPA 90A. Make air handling unit casing insulation uniform over the entire casing. Foil-faced insulation is not an acceptable substitute for use on double-wall access doors and inspections doors and casing sections.

g. Duct liner material, coating, and adhesive that conforms to fire-hazard requirements specified in DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING. Protect exposed insulation edges and joints where insulation panels are butted with a metal nosing strip or coat to meet erosion resistance requirements of ASTM C1071.

h. A latched and hinged inspection door, in the fan and coil sections. Plus additional inspection doors, access doors and access sections.

2.9.2.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

2.9.2.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.9.2.4 Fans

Provide the following:

a. Fans that are double-inlet, centrifugal type with each fan in a separate scroll. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the entire fan assembly. Mount fans on steel shafts, accurately ground and finished.

b. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11.Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.

c. Fans that are driven by a unit-mounted, or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Furnish belt guards that are the three-sided enclosed type with solid or expanded metal face. Belt drives

shall be designed for not less than a 1.3 service factor based on motor nameplate rating.

d. Motor sheaves that are variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by AHRI Guideline D. Where fixed sheaves are required, the use of variable pitch sheaves is allowed during air balance, but replace them with an appropriate fixed sheave after air balance is completed. Select variable pitch sheaves to drive the fan at a speed that produces the specified capacity when set at the approximate midpoint of the sheave adjustment. Furnish motors for V-belt drives with adjustable bases, and with open enclosures.

e. Motor starters of manual type with general-purpose enclosure. Select unit fan or fans to produce the required capacity at the fan static pressure with sound power level as indicated. Obtain the sound power level values according to AMCA 300, ASHRAE 68, or AHRI 260.

2.9.2.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

2.10 TERMINAL UNITS

2.10.1 Room Fan-Coil Units

Provide base units that include galvanized coil casing, coil assembly drain pan outside air damper, air filter, fans, motor, fan drive, motor switch, an enclosure for cabinet models and casing for concealed models, leveling devices integral with the unit for vertical type units, and sound power levels as indicated. Obtain sound power level data or values for these units according to test procedures based on AHRI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models are acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.Fasten each unit securely to the building structure. Provide units with capacity indicated. Provide room fan-coil units that are certified as complying with AHRI 440, and meet the requirements of UL 1995.

2.10.1.1 Enclosures

Fabricate enclosures from not lighter than 18 gauge steel, reinforced and braced. Provide enclosures with front panels that are removable and have 1/4 inch closed cell insulation or 1/2 inch thick dual density foil faced fibrous glass insulation. Make the exposed side of a high density, erosion-proof material suitable for use in air streams with velocities up to 4,500 fpm. Provide a discharge grille that is adjustable and that is of such design as to properly distribute air throughout the conditioned space. Plastic discharge and return grilles are acceptable provided the plastic material is certified by the manufacturer to be classified as flame resistant according to UL 94 and the material complies with the heat

deflection criteria specified in UL 1995. Provide galvanized or factory finished ferrous metal surfaces with corrosion resistant enamel, and access doors or removable panels for piping and control compartments, plus easy access for filter replacement. Provide duct discharge collar for concealed models.

2.10.1.2 Fans

Provide steel or aluminum, multiblade, centrifugal type fans. In lieu of metal, fans and scrolls could be of non-metallic materials of suitably reinforced compounds with smooth surfaces. Dynamically and statically balance the fans. Provide accessible assemblies for maintenance. Disassemble and re-assemble by means of mechanical fastening devices and not by epoxies or cements.

2.10.1.3 Coils

Fabricate coils from not less than 3/8 inch outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Provide coils with not less than 1/2 inch outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Test coils hydrostatically at 300 psi or under water at 250 psi air pressure. Provide coils suitable for 200 psi working pressure. Make provisions for coil removal.

2.10.1.4 Drain Pans

Size and locate drain and drip pans to collect all water condensed on and dripping from any item within the unit enclosure or casing. Provide condensate drain pans designed for self-drainage to preclude the buildup of microbial slime and thermally insulated to prevent condensation and constructed of not lighter than 21 gauge type 304 stainless steel or noncorrosive ABS plastic. Provide insulation with a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and of a waterproof type or coated with a waterproofing material. Design drain pans so as to allow no standing water and pitch to drain. Provide minimum 3/4 inch NPT or 5/8 inch OD drain connection in drain pan. Provide plastic or metal auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages; if metal, provide auxiliary pans that comply with the requirements specified above. Extend insulation at control and piping connections 1 inch minimum over the auxiliary drain pan.

2.10.1.5 Manually Operated Outside Air Dampers

Provide manually operated outside air dampers according to the arrangement indicated, and parallel airfoil type dampers of galvanized construction. Provide blades that rotate on stainless steel or nylon sleeve bearings.

2.10.1.6 Filters

Provide filters of the fiberglass disposable type, 1 inch thick, conforming to ASTM F 1040. Filters in each unit shall be removable without the use of tools.

2.10.1.7 Motors

Provide motors of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Provide motors with permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Provide a motor power consumption, shown in watts, at the fan operating speed selected to meet the specified capacity that does not exceed the following values:

Free Discharge Motors			
Unit Capacity (L/S) (cfm)	Maximum Power Consumption (Watts)		
	115V	230V	277V
94200	70	110	90
142300	100	110	110
189400	170	150	150
283600	180	210	220
378800	240	240	230
4721000	310	250	270
5661200	440	400	440

High Static Motors	
Unit Capacity (L/S) (cfm)	Maximum Power Consumption (Watts)
94200	145
142300	145
189400	210
283600	320
378800	320
4721000	530
5661200	530

2.10.2 Variable Air Volume (VAV) Units

a. Provide VAV units that are the type, size, and capacity shown, mounted in the ceiling or wall cavity, plus units that are suitable for single duct system applications. Provide actuators and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. For each VAV terminal unit, provide a temperature sensor in the unit discharge ductwork.

b. Provide unit enclosures that are constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Provide single or multiple discharge outlets as required. Units with flow limiters are not acceptable. Provide unit air volume that is factory preset and readily field adjustable without special tools.

c. Attach a flow chart to each unit. Base acoustic performance of the terminal units upon units tested according to AHRI 880 with the calculations prepared in accordance with AHRI 885. Provide sound power level as indicated. Show discharge sound power for minimum and 1-1/2 inches water gauge inlet static pressure. Provide acoustical lining according to NFPA 90A.

2.10.2.1 Variable Volume, Single Duct Terminal Units

Provide variable volume, single duct, terminal units with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Provide units that control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Provide units with an internal resistance not exceeding 0.4 inch water gauge at maximum flow range. Provide external differential pressure taps separate from the control pressure taps for air flow measurement with a 0 to 1 inch water gauge range.

2.11 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A123/A123M or ASTM A924/A924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B117, ASTM D1654, and ASTM D3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D520 Type I.

Factory painting that has been damaged prior to acceptance by the Contracting Officer shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.12 SUPPLEMENTAL COMPONENTS/SERVICES

2.12.1 Refrigerant Piping

The requirements for refrigerant piping are specified in Section 23 23 00 REFRIGERANT PIPING.

2.12.2 Condensate Drain Lines

Provide and install condensate drainage for each item of equipment that generates condensate in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.12.3 Backflow Preventers

The requirements for backflow preventers are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.12.4 Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.12.5 Controls

The requirements for controls are specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS and Section 23 09 23.13 20 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of 3 feet. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices)and an additional 3 feet.

c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

3.2.1 Condensate Drain Lines

Provide water seals in the condensate drain from all units room . Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2.2 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS. Provide concrete for foundations as specified in DIVISION 03 - CONCRETE.

3.2.3 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced. Provide access panels as specified in DIVISION 05 - METALS.

3.2.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

3.2.5 Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

3.2.6 Acoustical Duct Lining

Apply lining in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C916, Type I, NFPA 90A, UL 723, and ASTM E84. Provide top and bottom pieces that lap the side pieces and are secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA 1966. Provide welded pins, cup-head pins, or adhered clips that do not distort the duct, burn through, nor mar the finish or the surface of the duct. Make pins and washers flush with the surfaces of the duct liner and seal all breaks and punctures of the duct liner coating with the nonflammable, fire resistant adhesive. Coat exposed edges of the liner at the duct ends and at other joints where the lining is subject to erosion with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Apply duct liner to flat sheet metal prior to forming duct through the sheet metal brake. Additionally secure lining at the top and bottom surfaces of the duct by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA 1966 to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, are acceptable.

3.2.7 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

3.2.8 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit.

3.2.9 Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.2.10 Power Roof Ventilator Mounting

Provide foamed 1/2 inch thick, closed-cell, flexible elastomer insulation to cover width of roof curb mounting flange. Where wood nailers are used, predrill holes for fasteners.

3.2.11 Power Transmission Components Adjustment

Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.3 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 28 calendar days before being loaded.

3.4 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.5 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks.

3.6 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

a. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 20.

b. Framed Prepared Openings: Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.

c. Insulation: Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.

d. Closure Collars: Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation.Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.

e. Firestopping: Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING.

3.7 FIELD PAINTING OF MECHANICAL EQUIPMENT

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 120 degrees F. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

a. Temperatures less than 120 degrees F: Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat to metal surfaces subject to temperatures less than 120 degrees F.

b. Temperatures between 120 and 400 degrees F: Apply two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of two mils to metal surfaces subject to temperatures between 120 and 400 degrees F.

c. Temperatures greater than 400 degrees F: Apply two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of two mils to metal surfaces subject to temperatures greater than 400 degrees F.

3.8 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.9 DUCTWORK LEAK TESTS

The requirements for ductwork leak tests are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.10 DAMPER ACCEPTANCE TEST

Submit the proposed schedule, at least 2 weeks prior to the start of test. Operate all fire dampers and smoke dampers under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Test each fire damper equipped with fusible link by having the fusible link cut in place. Test dynamic fire dampers with the air handling and distribution system running. Reset all fire dampers with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, install the damper so it is square and free from racking.

3.11 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.12 PERFORMANCE TESTS

After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general operating tests by an experienced engineer. Provide tests that cover a period of not less than 5 days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

Submit test reports for the ductwork leak test, and performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.13 CLEANING AND ADJUSTING

Inside of fan-coil units and air terminal units, thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and install new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Maintain system in this clean condition

until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer.Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.14 OPERATION AND MAINTENANCE

3.14.1 Operation and Maintenance Manuals

Submit two manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in DIVISION 01 - GENERAL REQUIREMENTS. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

3.14.2 Operation and Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of 8 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Certification

1.3 RELATED REQUIREMENTS

This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.4.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.4.4 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.4.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.4.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.4.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's

recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under DIVISION 26 - ELECTRICAL. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of DIVISION 26 - ELECTRICAL.

1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified by a task order, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

1.8 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be

in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

-- End of Section --

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(2002; 6th ed) National Standards for Total System Balance
AABC MN-4	(1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV	(2006) Procedural Standards for Measurements and Assessment of Sound and Vibration
NEBB PROCEDURAL STANDARDS	(2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1143	(1985) HVAC Air Duct Leakage Test Manual, 1st Edition
SMACNA 1780	(2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition
SMACNA 1858	(2004) HVAC Sound And Vibration Manual - First Edition

1.2 DEFINITIONS

a. AABC: Associated Air Balance Council.

b. COR: Contracting Officer's Technical Representative.

c. DALT: Duct air leakage test

d. DALT'd: Duct air leakage tested

e. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.

f. NEBB: National Environmental Balancing Bureau

g. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING." When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."

h. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.

i. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.

j. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.

k. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).

l. TAB: Testing, adjusting, and balancing (of HVAC systems).

m. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.

n. TAB Agency: TAB Firm

o. TAB team field leader: TAB team field leader

p. TAB team supervisor: TAB team engineer.

q. TAB team technicians: TAB team assistants.

r. TABB: Testing Adjusting and Balancing Bureau.

1.2.1 Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems	International Standards for Environmental Systems Balance
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures	Field Readiness Check & Prelim. Field Procedures

1.3 WORK DESCRIPTION

The work includes duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air distribution systems including ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.2 Related Requirements

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Specific requirements related to Reliability Centered Maintenance (RCM) principles and Predictive Testing and Inspection (PTI), by the construction Contractor to detect latent manufacturing and installation defects must be followed as part of the Contractor's Quality Control program. Refer to the paragraph titled, Sustainability, for detailed requirements.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Pre-Final DALT report;

Final DALT report;
DALT and TAB Work Execution Schedule;

DALT and TAB Procedures Summary;

Design review report;

TAB report;

SD-07 Certificates

Prerequisite HVAC Work Check Out List;

Advanced notice for TAB field work;

Independent TAB agency and personnel qualifications;

Advance notice of Pre-Final DALT field work;

Completed Pre-Final DALT Work Checklist;

Advance Notice of TAB Field Work;

Completed Pre-TAB Work Checklist;

DALT and TAB Submittal and Work Schedule;

Design review report;

Pre-field DALT preliminary notification;

Pre-field TAB engineering report;

1.5 QUALITY ASSURANCE

1.5.1 Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Contracting Officer for approval:

a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.

c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.6 SEQUENCING AND SCHEDULING

1.6.1 DALT and TAB Submittal and Work Schedule

Comply with additional requirements specified in Appendix C: DALT AND TAB SUBMITTAL AND WORK SCHEDULE included at the end of this section

1.6.2 DALT and TAB Submittal and Work Schedule

Submit this schedule, and TAB Schematic Drawings, adapted for the particular project, to the Contracting Officer (CO) for review and approval. Include with the submittal the planned calendar dates for each submittal or work item.

1.6.2.1 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.6.2.2 Pre-Field DALT Preliminary Notification

Notification: On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing within 7 calendar days after completion.

1.6.2.3 Pre-Field TAB Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

(1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.

(2) Air System Diagrams: Use the contract drawings and duct fabrication drawings if available to provide air system diagrams in the report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagrams which identifies each outlet contained in the outlet airflow report sheets. Show intended locations of all traverses and static pressure readings.

(3) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or SMACNA 1780 data report forms with the following pre-field information filled in:

(1) Design data obtained from system drawings, specifications, and approved submittals.

(2) Notations detailing additional data to be obtained from the contract site by the TAB field team.

(3) Designate the actual data to be measured in the TAB field work.

(4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. Place the instrument key number in the blank space where the measured data would be entered.

c. Prerequisite HVAC work checkout list: Provide a list of inspections and work items which are to be completed by the Contractor. This list must be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.

At a minimum, a list of the applicable inspections and work items listed in the NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" must be provided for each separate system to be TAB'd.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section as specified in Appendix A WORK DESCRIPTIONS OF PARTICIPANTS.

3.2 PRE-DALT/TAB MEETING

Meet with the Contracting Officer's representative (COR) to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3 DALT PROCEDURES

3.3.1 Instruments, Consumables and Personnel

Provide instruments, consumables and personnel required to accomplish the DALT field work. Follow the same basic procedure specified below for TAB Field Work, including maintenance and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

3.3.2 Advance Notice of Pre-Final DALT Field Work

On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing prior to the COR's duct selection field visit.

3.3.3 Ductwork To Be DALT'd

From each duct system indicated as subject to DALT, the COR will randomly select sections of each completed duct system for testing by the Contractor's TAB Firm. The sections selected will not exceed 20 percent of the total measured linear footage of duct systems indicated as subject to DALT. Sections of duct systems subject to DALT will include 20 percent of main ducts, branch main ducts, branch ducts and plenums for supply, return, exhaust, and plenum ductwork.

It is acceptable for an entire duct system to be DALT'd instead of disassembling that system in order to DALT only the 20 percent portion specified above.

3.3.4 DALT Testing

Perform DALT on the HVAC duct sections of each system as selected by the COR. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in SMACNA 1143.

In spite of specifications of SMACNA 1143 to the contrary, DALT ductwork of construction class of 3-inch water gauge static pressure and below if indicated to be DALT'd. Complete DALT work on the COR selected ductwork within 48 hours after the particular ductwork was selected for DALT.

Separately conduct DALT work for large duct systems to enable the DALT work to be completed in 48 hours.

3.3.5 Pre-final DALT Report

After completion of the DALT work, prepare a Pre-final DALT Report meeting the additional requirements specified in Appendix B REPORTS - DALT and TAB. Data required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the Pre-final DALT report shall provide the basis for the Final DALT Report.

TAB supervisor shall review, approve and sign the Pre-Final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COR that the field check of the Pre-Final DALT Report data can commence.

3.3.6 Quality Assurance - COR DALT Field Acceptance Testing

In the presence of the COR and TAB team field leader, verify for accuracy Pre-final DALT Report data selected by the COR. For each duct system, this acceptance testing shall be conducted on a maximum of 50 percent of the duct sections DALT'd.

Further, if any data on the Pre-final DALT report form for a given duct section is out-of-tolerance, then field acceptance testing shall be conducted on data for one additional duct section, preferably in the same duct system, in the presence of the COR.

3.3.7 Additional COR Field Acceptance Testing

If any of the duct sections checked for a given system are determined to have a leakage rate measured that exceeds the leakage rate allowed by SMACNA Leak Test Manual for an indicated duct construction class and sealant class, terminate data checking for that section. The associated Pre-final DALT Report data for the given duct system will be disapproved. Make the necessary corrections and prepare a revised Pre-final DALT Report. Reschedule a field check of the revised report data with the COR.

3.3.8 Certified Final DALT Report

On successful completion of all field checks of the Pre-Final DALT Report data for all systems, the TAB Supervisor shall assemble, review, approve, sign and submit the Final DALT Report in compliance with Appendix B REPORTS - DALT and TAB to the Contracting Officer for approval.

3.3.9 Prerequisite for TAB Field Work

Do not commence TAB field work prior to the completion and approval, for all systems, of the Final DALT Report.

3.4 TAB PROCEDURES

3.4.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the the requirements of AABC MN-1, or SMACNA 1780 (TABB) and SMACNA 1858 (TABB),except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Conduct TAB work, including measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC MN-4, or NEBB TABES and NEBB MASV, or SMACNA 1780 (used by TABB) and SMACNA 1858 sound measurement procedures, except as supplemented and modified by this section.

3.4.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.4.3 TAB Air Distribution Systems

3.4.3.1 Units With Coils

Report heating and cooling performance capacity tests for hot water, chilled water, DX and steam coils for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

a. For air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of AABC MN-4, Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with AABC MN-4, Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

b. For units with capacities of 7.5 tons (90,000 Btu) or less, such as fan coil units, duct mounted reheat coils associated with VAV terminal units, and unitary units, such as through-the-wall heat pumps:

Determine the apparent coil capacity by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; submit the calculations with the coil reports.

3.4.3.2 Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, variable air volume boxes, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

3.4.3.3 Outside Air Units

Outside air unit systems including fans, coils, ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.4 Cassette and Horizontal Ducted Units

Cassettes and horizontal ducted unit systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

3.4.3.5 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.4.4 TAB Work on Performance Tests Without Seasonal Limitations

3.4.4.1 Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the heating systems and cooling systems.

3.4.4.2 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.4.5 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air and water flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Contracting Officer for direction.

3.4.6 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.4.7 TAB Reports

Additional requirements for TAB Reports are specified in Appendix B REPORTS - DALT and TAB

3.4.8 Quality Assurance - COR TAB Field Acceptance Testing

3.4.8.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COR, random selections of data (water, air quantities, and air motion) recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: Air handling units, cassettes and horizontal duct mounting units.

Group 2: 25 percent of the Change-over Bypass Dampers and associated diffusers and registers.

Group 3: 25 percent of the supply diffusers, registers, grilles associated with constant volume air handling units.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply and exhaust fans.

Further, if any data on the TAB Report for Groups 2 through 5 is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, additional group data verification is required in the presence of the COR. Verify TAB Report data for one additional piece of equipment in that group. Continue this additional group data verification until out-of-tolerance data ceases to be found.

3.4.8.2 Additional COR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the

necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COR.

3.4.8.3 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

3.5 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.6 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

3.7 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS
Appendix B REPORTS - DALT and TAB
Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE
Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

Appendix A

WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

1. Contractor

a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.

b. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.

c. Pre-DALT and TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.

d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.

e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph entitled "Construction Deficiencies." Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.

f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.

g. Give Notice of Testing: Submit advance notice of TAB field work accompanied by completed prerequisite HVAC Work List

h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.

b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.

c. Submittals: Provide the submittals specified herein.

d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.

e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the DALT or TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.

h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.

i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph entitled "Construction Deficiencies."

Resolve each deficiency as soon as practical and submit revised schedules and other required documentation.

j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.

3. TAB Team Field Leader

a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."

b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.

c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

Appendix B

REPORTS - DALT and TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. DALT and TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. Include the following:

a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.

b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.

c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.

d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.

e. A list of DALT and TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.

f. A thorough checklist of the work items and inspections that need to be accomplished before DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.

g. A thorough checklist of the work items and inspections that need to be accomplished before the TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-TAB Work Checklist before the TAB field work can be accomplished.

h. The checklists specified above shall be individually developed and tailored specifically for the work under this contract. Refer to NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under the paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" for examples of items to include in the checklists.

3. Design Review Report

Submit report containing the following information:

a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.

b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.

4. Pre-Final DALT Report for COR DALT Field Checks

Report the data for the Pre-Final DALT Report meeting the following requirements:

a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.

b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1143. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.

c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.

d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.
Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.

e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

5. Final DALT Report

On successful completion of all COR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

6. TAB Reports: Submit TAB Report in the following manner:

a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.

b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.

c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:

All occupied spaces.

(1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.

(2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.

(3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the TAB Report.

d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.

e. Air Static Pressure Profiles: Report static pressure profiles for air duct systems including: AHU-1, OAU-1, and AH-1 types. Report static pressure data for all supply, return, relief, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB or TABB required data, the following:

(1) Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.

(2) Report static pressure drop across chilled water coils, DX coils, hot water coils, steam coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.

(3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.

(4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

(5) Report static pressure drop across outside air and relief/exhaust air louvers.

(6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.

f. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

g. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.

h. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.

i. Data From TAB Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

-- End of Section --

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A240/A240M	(2011a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A580/A580M	(2008) Standard Specification for Stainless Steel Wire
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C1126	(2011e1) Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C1136	(2010) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1290	(2011) Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C1427	(2007e1) Specification for Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form

ASTM C195	(2007) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C449	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C533	(2011) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534/C534M	(2008) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C547	(2011) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C591	(2011) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C610	(2010) Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM C647	(2008) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C795	(2008) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

ASTM D882	(2010) Tensile Properties of Thin Plastic Sheeting
ASTM E2231	(2009) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
ASTM E84	(2011b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2010) Standard Test Methods for Water Vapor Transmission of Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2012) Standard for the Installation of Warm Air Heating and Air Conditioning Systems

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T403 OM	(2010) Bursting Strength of Paper

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-24179	(1969; Rev A; Am 2 1980; Notice 1 1987) Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-A-3316	(1987; Rev C; Am 2 1990) Adhesives, Fire-Resistant, Thermal Insulation

UNDERWRITERS LABORATORIES (UL)

UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials

UL 94 (1996; Reprint Oct 2010) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SYSTEM DESCRIPTION

1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

1.2.2 Surface Burning Characteristics

Unless otherwise specified, insulation shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Test specimens shall be prepared and mounted according to ASTM E2231. Insulation materials located exterior to the building perimeter are not required to be fire rated.

1.2.3 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meets all other requirements of this section. The minimum recycled material content of the following insulation are:

Rock Wool	75 percent slag of weight
Fiberglass	20-25 percent glass cullet by weight
Rigid Foam	9 percent recovered material

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-03 Product Data

Pipe Insulation Systems;
Duct Insulation Systems;

SD-04 Samples

Thermal Insulation;

SD-08 Manufacturer's Instructions

Pipe Insulation Systems;

Duct Insulation Systems;

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material. Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet. Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems which are located within, on, under, and adjacent to buildings; and for plumbing systems. Insulation shall be CFC and HCFC free.

2.2 MATERIALS

Provide insulation that meets or exceed the requirements of ASHRAE 90.1 - IP. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C795 requirements. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free and conform to the following:Flexible Elastomeric: Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive. Comply with ASTM C534/C534M, Type I, Grade 1, for tubular materials and Type II, Grade 1, for sheet

materials. Provide product recognized under UL 94 and listed in FM APP GUIDE.

2.2.1 Adhesives

2.2.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C916, Type I.

2.2.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C195.

2.2.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Adhesive shall be MIL-A-3316, Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation. Submit and display, after approval of materials, actual sections of installed systems, properly insulated in accordance with the specification requirements. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

a. Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

b. Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A temporary covering shall be used to enclose and protect display sections for duct insulation exposed to weather.

2.2.2 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product recognized under UL 94 and listed in FM APP GUIDE.

2.2.3 Caulking

ASTM C920, Type S, Grade NS, Class 25, Use A.

2.2.4 Corner Angles

2.2.4.1 General

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209, Alloy 3003, 3105, or 5005.

2.2.4.2 Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor).

2.2.5 Finishing Cement

ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C795.

2.2.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

2.2.7 Staples

Outward clinching type monel.

2.2.8 Jackets

2.2.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.2.8.2 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

2.2.9 Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber, cellular glass, polyisocyanurate, and phenolic foam. Insulation materials that do not require jacketing are flexible elastomerics. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.9.1 White Vapor Retarder All Service Jacket (ASJ)

Standard reinforced fire retardant jacket for use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.2.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings

a. The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Less than 0.02 permeability when tested in accordance with ASTM E96/E96M. Meeting UL 723 or ASTM E84 flame and smoke requirements; UV resistant.

b. The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined according to procedure B of ASTM E96/E96M utilizing apparatus described in ASTM E96/E96M. The coating shall be a nonflammable, fire resistant type. All other application and service properties shall be in accordance with ASTM C647.

2.2.9.3 Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and excellent WVT.

2.2.9.4 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 30 lb/inch when tested in accordance with ASTM D882, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.9.5 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for Laminated Film Vapor Retarder above.

2.2.9.6 Vapor Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with ASTM E96/E96M). Vapor barrier shall meet UL 723 or ASTM E84 25 flame and 50 smoke requirements; and UV resistant. Minimum burst strength 185 psi in accordance with TAPPI T403 OM. Tensile strength 68 lb/inch width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

2.2.10 Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.11 Wire

Soft annealed ASTM A580/A580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2.12 Insulation Bands

Insulation bands shall be 1/2 inch wide; 26 gauge stainless steel.

2.2.13 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.3 PIPE INSULATION SYSTEMS

Insulation materials shall conform to Table 1. Insulation thickness shall be as listed in Table 2 and meet or exceed the requirements of ASHRAE 90.1 - IP. Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 Aboveground Cold Pipeline (-30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

a. Cellular Glass: ASTM C552, Type II, and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

b. Flexible Elastomeric Cellular Insulation: ASTM C534/C534M, Grade 1, Type I or II. Type II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation.

c. Phenolic Insulation: ASTM C1126, Type III. Phenolic insulations shall comply with ASTM C795 and with the ASTM C665 paragraph Corrosiveness. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

d. Polyisocyanurate Insulation: ASTM C591, type I. Supply the insulation with manufacturer's recommended factory-applied vapor retarder/vapor barrier. Insulation with pre-applied adhesive shall not be used.

e. Flexible Polyolefin Cellular Insulation: ASTM C1427, Grade 1 Type I or II.

f. Mineral Fiber Insulation with Integral Wicking Material (MFIWM): ASTM C547. Install in accordance with manufacturer's instructions.

2.3.2 Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

a. Mineral Fiber: ASTM C547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

b. Calcium Silicate: ASTM C533, Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket/vapor barrier.

c. Cellular Glass: ASTM C552, Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

d. Flexible Elastomeric Cellular Insulation: ASTM C534/C534M, Grade 1, Type I or II to 220 degrees F service.

e. Phenolic Insulation: ASTM C1126 Type III to 250 degrees F service shall comply with ASTM C795. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

f. Perlite Insulation: ASTM C610

g. Polyisocyanurate Insulation: ASTM C591, Type 1, to 300 degrees F service. Supply the insulation with manufacturer's recommended factory applied jacket/vapor barrier.

h. Flexible Polyolefin Cellular Insulation: ASTM C1427, Grade 1 Type I or II to 200 degrees F.

2.4 DUCT INSULATION SYSTEMS

2.4.1 Duct Insulation

Provide factory-applied cellular glass polyisocyanurate or phenolic foam insulation with insulation manufacturer's standard reinforced fire-retardant vapor barrier, with identification of installed thermal resistance (R) value and out-of-package R value.

2.4.1.1 Rigid Insulation

Rigid mineral fiber in accordance with ASTM C612, Class 2 (maximum surface temperature 400 degrees F), 3 pcf average, 1-1/2 inch thick, Type IA, IB, II, III, and IV.

2.4.1.2 Blanket Insulation

Blanket flexible mineral fiber insulation conforming to ASTM C553, Type 1, Class B-3, 3/4 pcf nominal, 2.0 inches thick or Type II up to 250 degrees F. Also ASTM C1290 Type III may be used.

2.4.2 Duct Insulation Jackets

2.4.2.1 All-Purpose Jacket

Provide insulation with insulation manufacturer's standard reinforced fire-retardant jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jacket with a white surface suitable for field painting.

2.4.2.2 Metal Jackets

a. Aluminum Jackets: ASTM B209, Temper H14, minimum thickness of 27 gauge (0.016 inch), with factory-applied polyethylene and kraft paper

moisture barrier on inside surface. Provide smooth surface jackets for jacket outside dimension 8 inches and larger. Provide corrugated surface jackets for jacket outside dimension 8 inches and larger. Provide stainless steel bands, minimum width of 1/2 inch.

b. Stainless Steel Jackets: ASTM A167 or ASTM A240/A240M; Type 304, minimum thickness of 33 gauge (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 1/2 inch.

2.4.2.3 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive), heavy duty white or natural).

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi-layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.2 Firestopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION. The protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by UL, FM, or a NRTL.

3.1.3 Painting and Finishing

Painting shall be as specified in DIVISION 09 - FINISHES.

3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 220 degrees F. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish or PVC or metal jacketing as recommended by the manufacturer after the adhesive is dry and cured. A brush coating of adhesive shall be applied to both butt ends to be joined and to both slit surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.5 Welding

No welding shall be done on piping, duct</TAI> or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Air chambers.

e. Adjacent insulation.

f. ASME stamps.

g. Access plates of fan housings.

h. Cleanouts or handholes.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where pipes penetrate interior walls, the aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 plies standard grade, silver, white, black and embossed shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

h. For hot water pipes supplying lavatories or other similar heated service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.

i. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inches.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers in accordance with MSS SP-69, and Section 22 00 00 PLUMBING, GENERAL PURPOSE.

c. Horizontal pipes larger than 2 inches and below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, prefabricated insulation pipe hangers, perlite above 80 degrees F), or the necessary strength polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as

an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.1.5 Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, welded PVC, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket, - less than 0.0000 permeability; (greater than 3 ply, standard grade, silver, white, black and embossed) aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

3.2.1.6 Pipe Insulation Material and Thickness

TABLE 1
Insulation Material for Piping
Service

	Material	Specification	Type	Class	VR/VB Req'd
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping					
	Polyisocyanurate	ASTM C591	I		Yes
	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Flexible Polyolefin Cellular	ASTM C1427	I		No
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)					
	Mineral Fiber	ASTM C547	I	1	No
	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Polyisocyanurate	ASTM C591	I		No
Refrigerant Suction Piping (1.67 degrees C35 degrees Fnominal)					

	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Cellular Glass	ASTM C552	II	1	Yes
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Polyisocyanurate	ASTM C591	I		Yes
Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas for Handicapped Personnel					
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Flexible Polyolefin Cellular	ASTM C1427	I		No
Hoizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)					
	Polyisocyanurate	ASTM C591	I		Yes
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Cellular Glass	ASTM C552	III		Yes
Condensate Drain Located Inside Building					
	Polyisocyanurate	ASTM C591	I		Yes

	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	II		Yes
Note: VR/VB = Vapor Retarder/Vapor Barrier					

TABLE 2

Piping Insulation Thickness (mminch)
For flexible cellular foam the thickness should be 13mm instead of 15mm. Economic thicknessor prevention of condensation is the basis of these tables. If prevention of condensation is the criterion, the ambient temperature and relative humidity must bestated.

Service

	Material	Tube And Pipe Size (mm) (inch)				
		<25<1	25-<401-<1.5	40-<1001.5-<4	100-<2004-<8	> or = 200>8
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A

	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)						
	Mineral Fiber	251	251	251	401.5	401.5
	Cellular Glass	401.5	401.5	401.5	502	502
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Polyisocyanurate	251	251	251	251	401.5
Refrigerant Suction Piping (1.67 degrees C35 degrees Fnominal)						
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251

Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas forHandicapped Personnel						
	Flexible Elastomeric Cellular	130.5	130.5	130.5	130.5	130.5
Hoizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251
Condensate Drain Located Inside Building						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Faced Phenolic Foam	251	251	251	251	251

3.2.2 Aboveground Cold Pipelines

The following cold pipelines for minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

a. Make-up water.

b. Horizontal and vertical portions of interior roof drains.

c. Refrigerant suction lines.

d. Air conditioner condensate drains.

e. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

f. Domestic cold and chilled drinking water.

3.2.2.1 Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

3.2.2.2 Factory or Field applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or field applied seal welded PVC jacket or greater than 3 ply laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, standard grade, sliver, white, black and embossed for use with Mineral Fiber, Cellular Glass, Phenolic Foam, and Polyisocyanurate Foam Insulated Pipe. Insulation inside the building, to be protected with an aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, Embossed Silver, White & Black, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, White & Black, shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white & black, shall be provided for pipe insulation to the 6 ft level.

3.2.2.3 Installing Insulation for Straight Runs Hot and Cold Pipe

a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating, greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or PVDC adhesive tape.

b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. If staples are used, they shall be sealed in accordance with item "e." below. Note that staples are not required with cellular glass systems.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. The patch shall extend not less than 1-1/2 inches past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

h. Installation of flexible elastomeric cellular pipe insulation shall be by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut.Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives shall be used. Grade 1, Type II sheet insulation when used on pipe larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow'. Submit a booklet containing completed MICA Insulation Stds plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.

(1) The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.

(2) If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with either greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape, standard grade, silver, white, black and embossed or PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

3.2.3.1 General Requirements

All hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

a. Domestic hot water supply & re-circulating system.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.3.2 Insulation for Fittings and Accessories

a. General. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

b. Precut or Preformed. Precut or preformed insulation shall be placed around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

c. Rigid Preformed. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular

insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe.

PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant.

3.2.4.3 PVC Jacket

PVC jacket shall be ultraviolet resistant and adhesive welded weather tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.3 DUCT INSULATION SYSTEMS INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

3.3.1 Duct Insulation Thickness

Table 3		
Minimum Duct Insulation		
	Cooling	Heating

Duct Location	Annual Cooling Degree Days Base 18 C 65 F	Insulation R-Value (sm K)/W (h sf F)/Btu	Annual Heating Degree Days Base 18 C 65 F	Insulation R-Value (sm K)/W (h sf F)/Btu
Exterior of Building	<260500	0.583.3	<8161500	0.583.3
	260 - 621500 - 1150	0.885.0	816 - 24821500 - 4500	0.885.0
	622 - 10931151 - 2000	1.146.5	2483 - 41494501 - 7500	1.146.5
	>10932000	1.418.0	>41497500	1.418.0
	Temperature Difference	Insulation R-Value (sm K)/W (h sf F)/Btu	Temperature Difference	Insulation R-Value (sm K)/W (h sf F)/Btu
Inside building envelope or in unconditioned spaces	<815	None required	<815	None required
	8 <TD <2215 <TD <40	0.583.3	8 <TD <2215 <TD <40	0.583.3
	22 <TD40 <TD	0.885.0	22 <TD40 <TD	0.885.0

These R-values do not include the film resistances. The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit vapor transmission and condensation. Where ducts are designed to convey both heated and cooled air, duct insulation shall be as required by the most restrictive condition. Where exterior walls are used as plenum walls, wall insulation shall be a required by the most restrictive condition of this section or the insulation for the building envelope. Cooling ducts are those designed to convey mechanically cooled air or return ducts in such systems. Heating ducts are those designed to convey mechanically heated air or return ducts in such systems. Thermal resistance will be measured in accordance with ASTM C518 at a mean temperature of 24 degrees C 75 drgrees F. The Temperature difference is at design conditions between the space withinwhich the duct is located and the design air temperature in the duct. Resistance for runouts to terminal devices less than 3 m10 feet in length need not exceed 0.58 (sm K)/W3.3 (h sf F)/Btu. Unconditioned spaces include crawlspaces and attics.

Duct insulation thickness shall be in accordance with Table 4.

Table 4 - Minimum Duct Insulation (mm) (inches)	
Cold Air Ducts	502.0

Relief Ducts	401.5
Fresh Air Intake Ducts	401.5
Warm Air Ducts	502.0
Relief Ducts	401.5
Fresh Air Intake Ducts	401.5

3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible run-outs (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

i. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf, and rigid type where exposed, minimum density 3 pcf. Insulation for both concealed or exposed round/oval ducts shall be flexible type, minimum density 3/4 pcf or a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered. Insulation for all exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a field applied vapor retarder/vapor barrier jacket coating finish as specified, the total field applied dry film thickness shall be approximately 1/16 inch. Insulation on all concealed duct shall be provided with a factory-applied Type I or II vapor retarder/vapor barrier jacket. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder/vapor barrier shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder/vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, flexible insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder/vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Where mechanical fasteners are used, self-locking washers shall be installed and the pin trimmed and bent over.

f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

a. Supply ducts.

b. Return air ducts.

c. Relief air ducts

d. Flexible run-outs (field insulated).

e. Plenums.

f. Duct-mounted coil casings.

i. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, and rigid type where exposed. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured and stapled on 4 inch centers.

3.3.3.2 Installation on Exposed Duct

a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 16 inches apart and not more than 6 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.

b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin trimmed and bent over.

d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of tape and brushed with vapor retarder coating.

e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by staples spaced not more than 16 inches and not more than 6 inches from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

-- End of Section --

SECTION 23 08 00.00 23N

COMMISSIONING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA DCS	(1995, 2nd Ed) HVAC Duct Construction Standards - Metal and Flexible

1.2 DEFINITIONS

1.2.1 Commissioning

The process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent.

1.2.2 Commissioning Authority (Designation Ca)

The person, persons, or Company responsible, on the Government's behalf, for ensuring the commissioning process is fully carried out according to the contract requirements.

1.2.3 Commissioning Agent (Designation Cx)

The person responsible, on the contractors behalf, for carrying out the detailed planning, and implementation of, the commissioning process.

1.2.4 Design Agent (Designation D)

The Designer of Record. For IDIQ task orders, this is typically the Government PM.

1.2.5 TAB

Testing, Adjusting and Balancing

1.2.6 BAS

Building Automation System

1.2.7 DDC

Direct Digital Control

1.2.8 Season 1

That season when the HVAC System is up against maximum loading for the first time after completion of construction. Season 1 can be summer or winter depending on when construction is completed.

1.2.9 Season 2

That season when the HVAC System is up against maximum loading for the second time after completion of construction. Season 2 is the opposite of season 1. I.e. if Season 1 was summer, Season 2 will be winter.

1.2.10 Shoulder Season

That time of the season when the HVAC System is up against part load conditions.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Commissioning Team;

List of team members with company name and contact information who will represent the Contractor in the pre-commissioning checks and functional performance testing.

Test Reports;

All test reports, manufacturer's start-up tests, and executed and signed pre-commissioning checklists and functional performance test checklists required by the executive plan. The results of failed tests shall be included along with a description of the corrective action taken.

SD-07 Certificates

Certificates;

Provide Contractor's Commissioning Agent qualifications and resume. The Contractor's Commissioning Agent shall be Certified by a recognized Building HVAC Commissioning Program per the National Environmental Balancing Bureau or the Associated Air Balance Council or the Building Commissioning Association.

Additionally, for the Commissioning Agent proposed for approval, submit information certifying that the Commissioning Agent is part of the General Contractor's (GC's) staff or first tier certified TAB company or is a first tier subcontractor who is not affiliated with any other company participating in work on this contract.

SD-10 Operation and Maintenance Data

Operation and Maintenance;

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.4 SEQUENCING AND SCHEDULING

The work described in Checklist A of this Section shall be completed in conjunction with the startup of the HVAC systems and the related sections listed herein. The work described in Checklist B of this section shall begin only after all work required in this and related Sections has been successfully completed, and all tests and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Related Sections include, but are not limited to:

Section 01 45 00 CONSTRUCTION QUALITY CONTROL
Section 23 09 54.00 20 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC SYSTEMS
Section 23 08 00.00 20 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
Division 23XXX Mechanical systems as applicable

1.5 RELATED REQUIREMENTS

Requirements for construction scheduling, including commissioning activities, are specified in Section 01 32 00 PROJECT SCHEDULE.

Construction Quality Control Program commissioning requirements are specified in Section 01 45 00.

1.6 COMMISSIONING MEETINGS

Conduct weekly commissioning meetings during the period when commissioning activities take place.

1.7 PRICE AND PAYMENT PROCEDURES FOR COMMISSIONING RELATED ACTIVITIES

Payment for HVAC Systems shall not exceed 70% for the system labor and material cost until such time as the system commissioning as defined by this section is complete and accepted by the government.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. The Commissioning Agent is responsible for ensuring the completeness and technical accuracy of the commissioning plan. In addition, the Government will be represented by a representative of the Contracting Officer and the Design Agent's Representative. The team members shall be as follows:

Designation	Function
Cx	Contractor's Commissioning Agent
Q	Contractor's Quality Control Representative
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing Representative
C	Contractor's Controls Representative
D	Design Agent's Representative (Gov't)
Ca	Contracting Officer's Representative

Appendices A and B are provided as a general checklist and have been prepared to best match the various equipment selected during the design of this project. Each checklist shown in Appendices A and B shall be reviewed and modified as necessary to reflect all equipment actually installed during construction of the project. The commissioning team shall review the accuracy and applicability of each item in the checklist and revise as needed. Equipment shown in the checklist but not installed for the project shall be annotated as "NA". Likewise, equipment installed but not listed in the checklist shall be added or revised accordingly. A note as to why it was added or revised shall be inserted with the reviewer's initial. The commissioning team shall also add or modify to any of the equipment checklist items as required and/or specified by the equipment manufacturer. Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date, unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.

3.2 TESTS

The pre-commissioning checks and functional performance tests shall be performed on all HVAC equipment in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required, including part load testing. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members. The Contractor shall submit Test Reports as specified in the Submittals paragraph.

3.2.1 Pre-Commissioning Checks

Pre-commissioning checks shall be performed for the items indicated on the checklists in Appendix A. All related manufacturer's start up sheets shall

be attached to the appropriate checklist. Deficiencies discovered during these checks shall be documented, corrected and retested in accordance with the applicable contract requirements.

3.2.2 Functional Performance Tests

Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional performance tests shall begin only after all pre-commissioning checks and work required in specification sections listed in the SEQUENCING AND SCHEDULING section have been successfully completed. Tests shall prove Heating, Cooling and Part Load sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall document and correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

3.3 INDEX OF CHECK LISTS

A Pre-commissioning Check Lists

A-1 Structural/Architectural Checklist
A-2 Piping
A-3 Ductwork
A-6 Variable Volume Air Handling Unit
A-7 VAV Terminal
A-8 DX Air Cooled Condensing Unit
A-9 Pumps
A-10 Packaged Air Cooled Chiller
A-15 Blower Coil Unit
A-16 Fan Coil Unit
A-17 Unit Heater
A-18 Exhaust Fan
A-19 Make Up Air Fan
A-20 HVAC System Controls

B. Functional Performance Tests (FPT) and Check Lists

B-1 Pumps
B-4 VAV Terminals
B-5 Variable Volume Air Handling Unit
B-8 Packaged Air Cooled Chiller

B-11 Blower Coil Unit
B-12 Fan Coil Units
B-13 Unit Heaters

B-15 Make Up Air Fan
B-16 Exhaust Fan

3.4 APPENDIX A

PRE-COMMISSIONING CHECKLISTS

A-1 Pre-commissioning Checklist - Structural/Architectural Checklist

For Building or Zone:

Checklist Item	Q	M	E	T	C	D	Ca	Cx
a. Verify all piping,ductwork,EMT,etc. wall/ceiling and floor penetrations in Mesh. rooms or utility chases are sealed with approved fire stopping and/or weatherproof sealants.	___	X	X	X	X	___	_	___
b. Verify the fire rating for the Mesh. equipment room(s) is met per the plans and specs.	___	X	X	X	X	___	_	___
c. Verify the Bldg. envelope is sealed	___	X	X	X	X	___	_	___

per the plans and specs.

d.	Verify the fenestration is rated per the plans and specs and installed correctly. (Fire ratings, force protection, window system shading coefficient / emissivity).	___	XX	X	X	_____
e.	Verify the building is sealed and walls,doors,and dropped ceilings in place prior to the TAB air balance work.	___	X	X	___ X	_____

A-2 Pre-commissioning checklist - Piping

For Chilled Water Piping System

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).			X	X	X			
b. Piping complete.			X					
c. As-built shop drawings submitted.			X					
d. Piping flushed and cleaned and initial chemical treatment added.			X					
e. Strainers cleaned.			X					
f. Valves installed as required.			X		X			
g. Piping insulated as required.			X					
h. Thermometers and gauges installed as required.			X		X			
i. Verify operation of valves.			X					
j. Air vents installed as specified.			X	X	X			
k. Flexible connectors installed as specified			X	X	X			
l. Verify that piping has been labeled and valves identified as specified.			X					
m. Hydrostatic test complete.			X		X			
n. Verify insulation support blocks installed at piping loading points.			X		X			

A-3 Pre-commissioning Checklist - Ductwork

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Ductwork complete.			X		X			
c. As-built shop drawings submitted.			X		X			
d. Ductwork leak test complete.			X		X			
e. Fire dampers, smoke dampers, and access doors installed as required.			X		X			
e. Fire dampers, smoke dampers, and access doors installed as required with installation of each verified by the specified team members initialing each location on a copy of the as-built drawings.			X		X			
f. Ductwork insulated as required.			X		X			
g. Thermometers and gauges installed as required.								
h. Verify open/closed status of dampers.			X		X			
i. Verify smoke and fire damper operation.			X					
j. Flexible connectors installed as specified			X		X			
k. Verify duct systems installed per SMACNA DCS			X		X			

A-6 Pre-commissioning Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1, AHU-2

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			

b. Vibration isolation devices installed. _____ X X X _____

c. Inspection and access doors are operable and sealed.		X		X	
d. Casing undamaged.		X	X	X	
e. Insulation undamaged.		X	X	X	
f. Condensate drainage is unobstructed and sloped correctly. (Visually verify drainage by pouring a cup of water into drain pan.)		X	X	X	
g. Fan belt adjusted.		X		X	
h. Manufacturer's required maintenance clearance provided.		X	X	X	
Electrical					
a. Power available to unit disconnect.			X	X	
b. Power available to unit control panel.			X		
c. Proper motor rotation verified.				X	
d. Verify that power disconnect is located within sight of the unit it controls.			X		
f. Verify proper overload protection for motor starters.			X		
g. Verify that frequency drive, cables, and motor are compatible.			X		
h. Verify that the frequency drive programming is application specific.			X		
Coils					
a. Chilled water piping properly connected.		X	X	X	
b. Chilled water piping pressure tested.		X	X	X	
c. Air vents installed on water coils with shutoff valves as specified.		X	X	X	
d. Any damage to coil fins has been repaired.		X		X	
Controls					

a. Control valves/actuators properly installed.	_____	X	_____	___	___	
b. Control valves/actuators operable.	___	___	X	_____		

c. Dampers/actuators properly installed.		X				
d. Dampers/actuators operable.		X				
e. Verify proper location, installation and calibration of duct static pressure sensor.		X				
f. Fan air volume controller operable.		X				
g. Air handler controls system operational.		X				
Testing, Adjusting, and Balancing (TAB)						
a. Construction filters removed and replaced.			X		X	
b. Permanent Strainers cleaned or Construction strainers removed and replaced.		X		X		

A-7 Pre-commissioning Checklist - VAV Terminal

For all VAV Terminal

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. VAV terminal in place.			X	X	X			
c. VAV terminal ducted.			X	X	X			
d. VAV terminal connected to controls.			X	X				
e. Electric reheat coil connected to local disconnect and heater sized properly with proper overload protection.					X			
f. Manufacturer's required maintenance clearance provided.			X	X	X			
Controls								
a. Cooling only VAV terminal controls set.			X	X				
b. Cooling only VAV controls verified.			X	X				
c. Reheat VAV terminal controls set.			X	X				
d. Reheat terminal/coil controls verified.			X	X				
Testing, Adjusting, and Balancing (TAB)								
a. Verify terminal maximum air flow set.			X					
b. Verify terminal minimum air flow set.			X					
c. Verify that flow coefficient is programmed properly.			X					
d. Permanent Strainers cleaned or Construction strainers removed and replaced.			X		X			

A-9 Pre-commissioning Checklist - Pumps

For Pump: P-1, P-2

Checklist Item	Q	M	E	T	C	D	Ca	Cx

Installation					
a. Verify that item(s) installed meet approved submittal(s).			X	X	
b. Pump vibration isolation devices functional.		X	X	X	
c. Pump/motor coupling alignment verified.		X	X	X	
d. Piping system installed.		X	X	X	
e. Piping system pressure tested.		X	X	X	
f. Pump not leaking.		X	X	X	
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.		X	X	X	
h. Pressure/temperature gauges installed.		X		X	
i. Piping system cleaned.		X	X	X	
j. Chemical water treatment complete.		X	X	X	
Electrical					
a. Power available to pump disconnect.			X	X	
b. Pump rotation verified.			X	X	
c. Control system interlocks functional.			X		
d. Verify that power disconnect is located within sight of the unit it controls.			X		
e. Verify proper overload protection for motor starters.			X		
f. Verify that frequency drive, cables, and motor are compatible.			X		
g. Verify that the frequency drive programming is application specific.			X		

Testing, Adjusting, and Balancing (TAB)

a. Permanent Strainers cleaned or Construction strainers removed and replaced.	_____	X	___	X _____

A-10 Pre-commissioning Checklist - Packaged Air Cooled Chiller

For Chiller: ACC-1

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Chiller properly piped.			X					
c. Chilled water pipe leak tested.			X	X	X			
d. Verify that refrigerant used complies with specified requirements.			X	X	X			
e. Any damage to coil fins has been repaired.			X		X			
f. Manufacturer's required maintenance clearance provided.			X	X	X			
g. Verify proper chiller barrel and piping heat trace installed per manufacturer's recommendations.			X	X	X			
h. Verify unit has Hot Gas Bypass.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Power available to unit control panel.				X				
c. Separate power is supplied to electric heating tape with GFCI breakers.				X				
d. Verify that power disconnect is located within sight of the unit it controls.				X				
Controls								
a. Factory startup and checkout complete.			X	X				
b. Chiller safety/protection devices tested.			X	X				
c. Chilled water flow switch installed.			X	X				
d. Chilled water flow switch tested.			X	X				
e. Chilled water pump interlock installed.			X	X	X			

f. Chilled water pump interlock tested. _____ X _____ ___

[g. Verify low ambient controls. _____ X _____ ___] ___

A-15 Pre-commissioning Checklist - Blower Coil Unit

Blower Coil Unit

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).	___	_____		X	X		_____	
b. Vibration isolation devices installed.	_____		X	X	X		_____	
c. Access doors/removable panels are operable and sealed.	_____		X	___	X		_____	
d. Casing undamaged.	_____		X	X	X		_____	
e. Insulation undamaged.	_____		X	X	X		_____	
f. Condensate drainage is unobstructed and sloped correctly.	_____		X	X	X		_____	
g. Fan belt adjusted.	_____		X	___	X		_____	
h. Any damage to coil fins has been repaired.	_____		X	___	X		_____	
i. Manufacturer's required maintenance clearance provided.	_____		X	X	X		_____	
j. Verify installation of auxiliary drain pan for control valves.	_____		X	X	X		_____	
k. Verify air vent installed per manufacturer's recommendations.	_____		X	X	X		_____	
Electrical								
a. Power available to unit disconnect.	_____			X	_____			___
b. Power available to unit control panel.	_____			X	_____			___
c. Proper motor rotation verified.	___	___	_____		X		_____	
d. Verify that power disconnect is located within sight of the unit it controls.	_____			X	_____			___
e. Power available to electric heating coil.	_____	___	X		X		_____	
f. Verify proper overload protection for _____ motor starters.								

___ X _____

Controls

a. Control interlocks properly installed.			X		
b. Control interlocks operable.			X		
c. Dampers/actuators properly installed.		X			
d. Dampers/actuators operable.		X			
e. Verify proper location and installation of thermostat.		X			

A-16 Pre-commissioning Checklist - Fan Coil Unit

Fan Coil Unit

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Vibration isolation devices installed.			X	X	X			
c. Access doors/removable panels are operable and sealed.			X		X			
d. Casing undamaged.			X	X	X			
e. Insulation undamaged.			X	X	X			
f. Condensate drainage is unobstructed and sloped correctly.			X	X	X			
g. Fan belt adjusted.			X		X			
h. Any damage to coil fins has been repaired.			X		X			
i. Manufacturer's required maintenance clearance provided.			X	X	X			
j. Verify installation of auxiliary drain pan for control valves.			X	X	X			
k. Verify air vent installed per manufacturer's recommendations.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Power available to unit control panel.				X				
c. Proper motor rotation verified.					X			
d. Verify that power disconnect is located within sight of the unit it controls.				X				
e. Power available to electric heating coil.			X	X				

f. Verify proper overload protection for motor starters. _____ ___ X _____

Coils

a. Chilled water piping properly connected.		X	X	X		
b. Chilled water piping pressure tested.		X	X	X		
c. Verify coil filled and vented of air.			X			

Controls

a. Control valves/actuators properly installed.		X				
b. Control valves/actuators operable.		X	X			
c. Verify proper location and installation of thermostat.		X				

Testing, Adjusting, and Balancing (TAB)

a. Construction filters removed and replaced.			X			
b. Permanent Strainers cleaned or Construction strainers removed and replaced.		X		X		

A-17 Pre-commissioning Checklist - Unit Heater

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Any damage to coil fins has been repaired.			X		X			
c. Manufacturer's required maintenance/ operational clearance provided.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Proper motor rotation verified.				X	X			
c. Verify that power disconnect is located within sight of the unit it controls.				X				
d. Power available to electric heating coil.				X				
e. Verify proper overload protection for motor starters.				X				
Controls								
a. Control valves properly installed.			X					
b. Control valves operable.			X	X				
c. Verify proper location and installation of thermostat.			X					
Testing, Adjusting, and Balancing (TAB)								
a. Permanent Strainers cleaned or Construction strainers removed and replaced.			X		X			

A-18 Pre-commissioning Checklist - Exhaust Fan

For Exhaust Fan

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Fan belt adjusted.			X		X			
c. Verify all ductwork is installed per design.			X		X			
Electrical								
a. Power available to fan disconnect.				X				
b. Proper motor rotation verified.					X			
c. Verify that power disconnect is located within sight of the unit it controls.				X				
d. Verify proper overload protection for motor starters.				X				
Controls								
a. Control interlocks properly installed.				X				
b. Control interlocks operable.				X				
c. Dampers/actuators properly installed.			X					
d. Dampers/actuators operable.			X					
e. Verify proper location and installation of thermostat.			X					

A-19 Pre-commissioning Checklist - Make-Up Air Fan

Installation

a. Verify that item(s) installed meet approved submittal(s).			X	X	
b. Fan belt adjusted.		X		X	
c. Verify all ductwork is installed per design.		X		X	

Electrical

a. Power available to fan disconnect.		X			
b. Proper motor rotation verified.				X	
c. Verify that power disconnect is located within sight of the unit it controls.		X			
d. Verify proper overload protection for motor starters.			X		

Controls

a. Control interlocks properly installed.			X		
b. Control interlocks operable.			X		
c. Dampers/actuators properly installed.		X			
d. Dampers/actuators operable.		X			
e. Verify proper location and installation of thermostat.		X			

A-20 Pre-commissioning Checklist - HVAC System Controls

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Layout of control panel matches drawings.			X	X				
c. Control components piped and/or wired to each labeled terminal strip.			X	X				
d. Verify that control components are installed in the proper location.			X	X				
e. Verify that force protection shut down controls installed in proper location.			X	X				
f. DDC connection made to each labeled terminal strip as shown.			X	X				
g. Control wiring and tubing labeled at all terminations, splices, and junctions.			X	X				
h. Shielded wiring used on electronic sensors.			X	X				
i. Verify location and coordination of modem/communication line.			X	X				
j. Verify damper actuators mounted outside the airstream and attached to proper structural support.			X	X				
k. Verify thermostats are located on interior walls with specified options and set to design setpoints.			X	X				
l. Verify that workstation is in proper location and includes all specified interfaces.			X	X				

Main Power and Control Air

a. 110 volt AC power available to panel.			X		
b. 20 psig compressed air available to panel.		X	X		
c. Verify proper overload protection for motor starters.			X		
d. Verify proper sizing and installation of individual control transformers.			X		
e. Verify proper surge protection of incoming power, control wiring, and communication lines.			X		

3.5 APPENDIX B

FUNCTIONAL PERFORMANCE TESTS (FPT) AND CHECKLISTS

All equipment and control systems shall be operated through the entire specified sequence of operations, as directed by the government for witnessing and verifying acceptable operation. Government shall select of specific components or systems to be verified. A functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. Upon failure of any functional performance test, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. In the event of a failed FPT, Government shall have the right to require additional testing of at least similar systems. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members.

B-1 Functional Performance Test Checklist - Pumps

For Pump: P-1, P-2

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Verify automatic interface with local controller and BAS/ operator work station.

2. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

3. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-4 Functional Performance Test Checklist - VAV Terminals

VAV boxes (Cooling only, Reheat)

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	
Contractor's Mechanical Representative	
Contractor's Electrical Representative	
Contractor's Testing, Adjusting and Balancing Representative	
Contractor's Controls Representative	
Contracting Officer's Representative	

B-5 Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1, AHU-2

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

5. Verify that the Variable Frequency Drive is not capable of running at any critical vibration frequencies.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-8 Functional Performance Test Checklist - Packaged Air Cooled Chiller

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

5. Verify that the Variable Frequency Drive is not capable of running at any critical vibration frequencies.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-11 Functional Performance Test Checklist - Steam Boiler

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____

B-12 Functional Performance Test Checklist - Fan Coil Units

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____

B-13 Functional Performance Test Checklist - Unit Heaters

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-15 Functional Performance Test Checklist - Make Air Fan

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-16 Functional Performance Test Checklist - Exhaust Fan

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

-- End of Section --

SECTION 23 09 23.13 20

BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2007) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2010; INT 1 2011; Addenda AD & AE 2011) BACnet—A Data Communication Protocol for Building Automation and Control Networks

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1	(1999) Local Area Network: Token Bus

ASME INTERNATIONAL (ASME)

ASME B31.1	(2010) Power Piping
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-C	(2010) Control Network Protocol Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2008) Standard Requirements for Instrument Transformers
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.45	(2002; R 2008) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less)AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3	(2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code
NFPA 72	(2010; TIA 10-4) National Fire Alarm and Signaling Code
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449	(2006; Reprint Feb 2011) Surge Protective Devices
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 508A	(2001; Reprint Feb 2010) Industrial Control Panels
UL 916	(2007; Reprint Jun 2010) Standard for Energy Management Equipment

1.2 DEFINITIONS

1.2.1 ANSI/ASHRAE Standard 135

ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks, referred to as "BACnet". ASHRAE developed BACnet to provide a method for diverse building automation devices to communicate and share data over a network.

1.2.2 ARCNET

ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.

1.2.3 BACnet

Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

1.2.4 BACnet/IP

An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number. See also "BACnet Broadcast Management Device".

1.2.5 BACnet Internetwork

Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

1.2.6 BACnet Network

One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

1.2.7 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.2.8 BBMD

BACnet Broadcast Management Device (BBMD).A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

1.2.9 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

1.2.10 BAS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical support, control parameters, and daily operation. The BAS Owner for this project is Department of Homeland Security (DHS).

1.2.11 BIBBs

BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices.The “A” device uses data provided by the "B" device, or requests an action from the “B” device.

1.2.12 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

1.2.13 BI/BTL

BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

1.2.14 Bridge

Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

1.2.15 Broadcast

A message sent to all devices on a network segment.

1.2.16 Device

Any control system component, usually a digital controller, that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

1.2.17 Device Object

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

1.2.18 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and

BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported.

1.2.19 Digital Controller

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device".

1.2.20 Direct Digital Control (DDC)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

1.2.21 DDC System

A network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

1.2.22 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media.

1.2.23 Firmware

Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

1.2.24 Gateway

Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

1.2.25 Half Router

A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

1.2.26 Hub

A common connection point for devices on a network.

1.2.27 Internet Protocol (IP, TCP/IP, UDP/IP)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying

and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

1.2.28 Input/Output (I/O)

Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

1.2.29 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.

1.2.30 IP subnet

Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

1.2.31 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.2.32 LonTalk

CEA-709.1-C. A communication protocol developed by Echelon Corp. LonTalk is an optional physical and data link layer for BACnet.

1.2.33 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

1.2.34 Master-Slave/Token-Passing (MS/TP)

ISO 8802-3. One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

1.2.35 Native BACnet Device

A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

1.2.36 Network

Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®.

1.2.37 Network Number

A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

1.2.38 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

1.2.39 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

1.2.40 Object Properties

Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

1.2.41 Peer-to-Peer

Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

1.2.42 Performance Verification Test (PVT)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

1.2.43 PID

Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

1.2.44 PICS

Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

1.2.45 Points

Physical and virtual inputs and outputs. See also "Input/Output".

1.2.46 PTP

Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

1.2.47 Repeater

A network component that connects two or more physical segments at the physical layer.

1.2.48 Router

A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

1.2.49 Stand-Alone Control

Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS profile) communicating on a network with a parent device are exempt from stand-alone requirements.

1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

The paragraph specifies that all contract requirements of this section shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

1.4 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

a. Remove existing and provide new BACnet DDC systems including associated equipment and accessories. All new devices are accessible using a Web browser interface and communicate using ASHRAE 135 BACnet communications without the use of gateways, unless gateways are shown on the design drawings and specifically requested by the Government. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.

1.4.1 Design Requirements

1.4.1.1 Control System Drawings Title Sheet

Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings.

1.4.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria.

1.4.1.3 Control System Components List

Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number.For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

1.4.1.4 Control System Schematics

Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

a. Location of each input and output device

b. Flow diagram for each piece of HVAC equipment

c. Name or symbol for each control system component, such as V-1 for a valve

d. Setpoints, with differential or proportional band values

e. Written sequence of operation for the HVAC equipment

f. Valve and Damper Schedules, with normal (power fail) position

1.4.1.5 HVAC Equipment Electrical Ladder Diagrams

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

1.4.1.6 Component Wiring Diagrams

Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

1.4.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

1.4.1.8 BACnet Communication Architecture Schematic

Provide a schematic showing the project's entire BACnet communication network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks.

1.5 SUBMITTALS

Submit the in accordance to Section 01 33 00 – SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Include the following in the project's control system drawing set:

Control system drawings title sheet;

List of I/O Points;

Control System Components List;

Control system schematics;

HVAC Equipment Electrical Ladder diagrams;

Component wiring diagrams;

Terminal strip diagrams;

BACnet communication architecture schematic;

SD-03 Product Data

Direct Digital Controllers;

Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

BACnet Gateways;

Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

BACnet Protocol Analyzer;

Include capability to store and report data traffic on BACnet networks, measure bandwidth usage, filter information, and identify BACnet devices.

DDC Software;

Sensors and Input Hardware;

Output Hardware;

Surge and transient protection;

Indicators;

SD-05 Design Data

Performance Verification Testing Plan;

Pre-Performance Verification Testing Checklist;

SD-06 Test Reports

Performance Verification Testing Report;

SD-07 Certificates

Contractor's Qualifications;

SD-09 Manufacturer's Field Reports

Pre-PVT Checklist;

SD-10 Operation and Maintenance Data

Comply with requirements for data packages in DIVISION 01 - GENERAL REQUIREMENTS except as supplemented and modified in this specification.

BACnet Direct Digital Control Systems, Data Package 4;

Controls System Operators Manuals, Data Package 4;

SD-11 Closeout Submittals

Training documentation;

1.6 QUALITY ASSURANCE

1.6.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

1.6.2 Delivery, Storage, and Handling

Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6.3 Operating Environment

Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

1.6.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

1.6.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

1.6.6 Contractor's Qualifications

Submit documentation certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years.

1.6.7 Modification of References

The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

1.6.8 Project Sequence

The control system work for this project shall proceed in the following order:

a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."

b. Perform the control system installation work, including all field check-outs and tuning.

c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."

d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."

e. Submit and receive approval of the Performance Verification Testing Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."

f. Perform the Performance Verification Testing.

g. Submit and receive approval on the PVT Report.

h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL".

i. Deliver the final Controls System Operators Manuals.

j. Conduct Training.

k. Submit and receive approval of Closeout Submittals.

PART 2 PRODUCTS

2.1 DDC SYSTEM

a. Provide a networked DDC system for stand-alone control in compliance with the latest revision of the ASHRAE 135 BACnet standard. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet communications between the DDC system and native BACnet devices furnished with HVAC equipment. Devices provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing.

2.1.1 Direct Digital Controllers

Direct digital controllers shall be UL 916 rated.

2.1.1.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller.

2.1.1.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

2.1.1.3 Stand-Alone Control

Provide stand-alone digital controllers.

2.1.1.4 Internal Clock

Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.1.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power

source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

2.1.1.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.1.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

2.1.1.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

2.1.1.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.

b. Binary Inputs: Binary inputs shall have a toggle switch and monitor on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.

c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.

d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.

e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.

f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.

g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

2.1.1.10 Digital Controller BACnet Internetwork

Provide a BACnet internetwork with control products, communication media, connectors, repeaters, hubs, and routers. Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE 135, BACnet. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.

2.1.1.11 Communications Ports

a. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.

b. Telecommunications Interface Port: Provide one telecommunication port per building, permitting remote communication via point-to-point (PTP) protocol over telephone lines.

2.1.1.12 Modems

Provide v.92 modems where required for communication between the BACnet Operator Workstation (B-OWS) and the DDC system.

2.1.1.13 BACnet Gateways

Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Provide with each gateway an interoperability schedule showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

The following minimum capabilities are required:

a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.

b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.

c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.

d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.

e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.1.1.14 Digital Controller Cabinet

Provide each digital controller in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

2.1.1.15 Main Power Switch and Receptacle

Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

2.1.2 DDC Software

2.1.2.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

a. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.

b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.

c. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.

d. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

2.1.2.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

2.1.2.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

2.1.2.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

2.1.2.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

2.1.2.6 Timed Local Override

Provide an adjustable override time for each push of a timed local override button.

2.1.2.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

2.1.2.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

2.1.2.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out-Of-Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

2.1.2.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. When a computer workstation or web server is connected to the BACnet internetwork, alarms/events shall report to the computer, printer, alphanumeric pager, as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device and retrieved. Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

2.1.2.11 Trending

Provide BACnet trend services capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

The operator workstation shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification_Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the workstation and connected notebook computers.

2.1.2.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

2.1.2.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.1.3 BACnet Protocol Analyzer

Provide a BACnet protocol analyzer and required cables and fittings for connection to the BACnet network. The analyzer shall include the following minimum capabilities:

a. Capture and store to a file data traffic on all network levels.

b. Measure bandwidth usage.

c. Filtering options with ability to ignore select traffic.

2.2 SENSORS AND INPUT HARDWARE

Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

2.2.1 Field-Installed Temperature Sensors

Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2.2.1.1 Thermistors

Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.

2.2.1.3 Temperature Sensor Details

a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button with LED status indication, setpoint adjustment lever, without temperature display. Provide a hidden communication port or 802.11x wireless support for a portable operator interface like a notebook computer or PDA.

b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.

c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.

d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.

e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.2.2 Transmitters

Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

2.2.2.1 Relative Humidity Transmitters

Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

2.2.2.2 Pressure Transmitters

Provide transmitters integral with the pressure transducer.

2.2.3 Current Transducers

Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

2.2.4 Pneumatic to Electric Transducers

Pneumatic to electronic transducers shall convert a 0 to 20 psig signal to a proportional 4 to 20 mA or 0 to 10 VDC signal (operator scaleable). Supply voltage shall be 24 VDC. Accuracy and linearity shall be 1.0 percent or better.

2.2.5 Air Quality Sensors

Provide power supply for each sensor.

2.2.5.1 CO2 Sensors

Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

2.2.5.2 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and

calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.2.6 Input Switches

2.2.6.1 Timed Local Overrides

Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.2.7 Freeze Protection Thermostats

Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.2.8 Air Flow Measurement Stations

Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.2.9 Energy Metering

2.2.9.1 Electric Meters

Provide kilowatt-hour (kWh) meter(s) shown in accordance with NEMA/ANSI C12.10, suitable for the intended voltage, phases, and wye/delta configuration, with three current transformers and an output signal compatible with the DDC system.The meter shall have a box-mounted socket and an automatic circuit-closing bypass. Provide the meter with at least four pointer-type kWh registers, provisions for pulse initiation, and universal Class 2 indicating maximum kW demand register, sweep pointer indicating type, and a 15 minute interval. The meter accuracy shall be within plus or minus one percent of the actual kWh. Provide the correct multiplier on the meter face. Provide the current transformers in accordance with IEEE C57.13, with 600-volt insulation, and rated for metering with voltage, IL, momentary, and burden ratings coordinated with

the ratings of corresponding meters. Provide butyl-molded donut or window type transformers mounted on a bracket to allow secondary cables to connect to the transformer bushings. Provide wiring identification of the current transformer secondary feeders to permit field measurements to be taken with hook-on ammeters.

2.3 OUTPUT HARDWARE

2.3.1 Control Dampers

Provide factory manufactured galvanized steel dampers where indicated. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

Provide damper assembly frames constructed of 0.064 inch minimum thickness galvanized steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork subject to above 3-inch water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

Frames shall be at least 2 inches wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

The leakage rate of each damper when full-closed shall be no more than 4 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.3.2 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

2.3.2.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Thermal type actuators may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

2.3.3 Output Switches

2.3.3.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.4 ELECTRICAL POWER AND DISTRIBUTION

2.4.1 Transformers

Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

2.4.2 Surge and Transient Protection

Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.

b. The device shall react within 5 nanoseconds and automatically reset.

c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.

d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.

e. The primary suppression system components shall be pure silicon avalanche diodes.

f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.

g. The device shall have an indication light to indicate the protection components are functioning.

h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.

i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.

j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.

k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

2.4.2.2 Telephone and Communication Line Surge Protection

Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:

a. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.

b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.

c. The device shall be installed at the distance recommended by its manufacturer.

2.4.2.3 Controller Input/Output Protection

Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with DIVISION 26 - ELECTRICAL. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork.

2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.

b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

2.4.3.2 Analog Signal Wiring

Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair.Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

2.5 FIRE PROTECTION DEVICES

2.5.1 Duct Smoke Detectors

Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Provide UL listed or FM approved detectors, designed specifically for duct installation.

Furnish detectors under DIVISION 28 - ELECTRONIC SAFETY AND SECURITY and install under this section. Connect new detectors to the building fire alarm panel.

2.6 INDICATORS

2.6.1 Thermometers

Provide bi-metal type thermometers at locations shown. Thermometers shall have either 9 inch long scales or 3.5 inch diameter dials, with insertion, immersion, or averaging elements. Provide matching thermowells for pipe-mounted installations. Select scale ranges suitable for the intended service, with the normal operating temperature near the scale's midpoint. The thermometer's accuracy shall be plus or minus 2 percent of the scale range.

2.6.2 Pressure Gauges for Piping Systems

Provide pipe-mounted pressure gauges at the locations shown. Gauges shall conform to ASME B40.100 and have a 4-inch diameter dial and shutoff cock. Provide gauges in steam piping with a pressure snubber pigtail fitting. Select scale ranges suitable for the intended service, with the normal operating pressure near the scale's midpoint. The gauge's accuracy shall be plus or minus 2 percent of the scale range.

PART 3 EXECUTION

3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

3.1.1 BACnet Naming and Addressing

Coordinate with the BAS Owner and provide unique naming and addressing for BACnet networks and devices.

a. MAC Address

Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 00 to 64.

b. Network Numbering

Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object_Name" property names with plain-English descriptive names for each device
For example, the Device Object Name that for the device controlling the chiller plant at Building 3408 would be:

Device Object_Name = CW System B3408

A Device Object Name for a VAV box controller might be:

Device Object_Name = VAV BOX25

e. Object Name Property Text (Other than Device Objects)

The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

f. Object Identifier Property Number (Other than Device Objects)

Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

3.1.2 Minimum BACnet Object Requirements

a. Use of Standard BACnet Objects

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:
all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

Support and provide Description and/or Device_Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

Support and provide Inactive_Text and Active_Text property descriptions matching conditions shown on the points list.

e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

3.1.3 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

Priority Level	Application
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

b. Alarming

(1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.

(2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.

(3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

3.1.4 Local Area Networks

Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks.Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

3.1.5 BACnet Routers, Bridges, and Switches

Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an IP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment.

3.1.6 Wiring Criteria

a. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.

b. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.

c. Provide circuit and wiring protection required by NFPA 70.

d. Run all wiring located inside mechanical rooms in conduit.

e. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.

f. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination.

Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.

g. For controller power, provide new 120 VAC circuits, with ground. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.

h. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.

i. Grounding: Ground controllers and cabinets to a good earth ground as specified in DIVISION 26 - ELECTRICAL. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.

j. The Contractor shall be responsible for correcting all associated ground loop problems.

k. Run wiring in panel enclosures in covered wire track.

3.1.7 Accessibility

Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

3.1.8 Digital Controllers

a. Install as stand alone control devices (see definitions).

b. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

3.1.9 Hand-Off-Auto Switches

Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

3.1.10 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

3.1.10.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 54 inches above the floor to meet ADA requirements.

3.1.10.2 Duct Temperature Sensors

a. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.

b. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

3.1.10.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

3.1.10.4 Outside Air Temperature Sensors

Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

3.1.11 Energy Meters

Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

3.1.12 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

3.1.13 Thermometers and Gages

Mount devices to allow reading while standing on the floor or ground, as applicable.

3.1.14 Pressure Sensors

Locate pressure sensors as indicated.

3.1.15 Component Identification Labeling

Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

3.1.16 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 60 days advance notice of need.

3.2 TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING. This support shall include:

a. On-site operation and manipulation of control systems during the testing and balancing.

b. Control setpoint adjustments for balancing all relevant mechanical systems, including VAV boxes.

c. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.3 CONTROLS SYSTEM OPERATORS MANUALS

Provide one electronic and printed copy of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

a. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.

b. A copy of the project's mechanical design drawings, including any official modifications and revisions.

c. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."

d. A copy of the project's approved Performance Verification Testing Plan and Report.

e. A copy of the project's approved final TAB Report.

f. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.

g. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.

h. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.

i. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.

j. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.

k. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.

l. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

3.4 PERFORMANCE VERIFICATION TESTING (PVT)

3.4.1 General

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Government. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the BAS Owner.

3.4.2 Performance Verification Testing Plan

Submit a detailed PVT Plan of the proposed testing for Government approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be an clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project's sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the BAS Owner to acknowledge successful completion.

3.4.3 PVT Sample Size

Test all central plant equipment and primary air handling unit controllers unless otherwise directed. Twenty percent sample testing is allowed for identical controllers typical of terminal control like VAV boxes and fan coil units. The Government may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

The Government may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Government may choose which ones.

3.4.4 Pre-Performance Verification Testing Checklist

Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

b. Verify HVAC motors operate below full-load amperage ratings.

c. Verify all required control system components, wiring, and accessories are installed.

d. Verify the installed control system architecture matches approved drawings.

e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.

f. Verify all required surge protection is installed.

g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.

h. Verify all DDC network communications function properly, including uploading and downloading programming changes.

i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.

j. Verify each digital controller’s programming is backed up.

k. Verify all wiring, components, and panels are properly labeled.

l. Verify all required points are programmed into devices.

m. Verify all TAB work affecting controls is complete.

n. Verify all valve and actuator zero and span adjustments are set properly.

o. Verify all sensor readings are accurate and calibrated.

p. Verify each control valve and actuator goes to normal position upon loss of power.

q. Verify all control loops are tuned for smooth and stable operation. View trend data where applicable.

r. Verify each controller works properly in stand-alone mode.

s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.

t. Verify all electrical interlocks work properly.

u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook.

v. Verify the as-built (shop) control drawings are completed.

3.4.5 Conducting Performance Verification Testing

a. Conduct Government-witnessed PVT after approval of the PVT Plan and the completed Pre-PVT Checklist. Notify the Contracting Officer of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's

mechanical design drawings, the approved Pre-PVT Checklist, and the approved PVT Plan, conduct the PVT.

b. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.

c. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

3.4.6 Controller Capability and Labeling

Test the following for each controller:

a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.

b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.

c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network.

d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.

e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

3.4.7 Workstation and Software Operation

For every user workstation or notebook provided:

a. Show points lists agree with naming conventions.

b. Show that graphics are complete.

c. Show the UPS operates as specified.

3.4.8 BACnet Communications and Interoperability Areas

Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying

interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.

b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.

c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.

d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.

e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).

f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.

g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.

h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.

i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.

j. Device and Network Management: Show the following capabilities:

   (1) Display of Device Status Information

   (2) Display of BACnet Object Information

   (3) Silencing Devices that are Transmitting Erroneous Data

   (4) Time Synchronization

(5) Remote Device Reinitialization

(6) Backup and Restore Device Programming and Master Database(s)

(7) Configuration Management of Half-Routers, Routers and BBMDs

3.4.9 Execution of Sequence of Operation

Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

3.4.10 Control Loop Stability and Accuracy

For all control loops tested, give the Government trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

3.4.11 Performance Verification Testing Report

Upon successful completion of the PVT, submit a PVT Report to the Government and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

3.5 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location.

-- End of Section --

SECTION 23 81 00.00 20

UNITARY AIR CONDITIONING EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI DCUP	(Online) Directory of Certified Unitary Products
ANSI/AHRI 460	(2005) Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ANSI/ASHRAE 15 & 34	(2010; Addenda a, b, c, d, e, f, g, h, I, j, k, l, n and o; Errata 2011) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
ASHRAE 52.2	(2007; Addenda B 2008; Errata 2009, Errata 2010; INT 2010; Errata 2011) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 55	(2010; Errata 1 2011; Addenda A 2011) Thermal Environmental Conditions for Human Occupancy
ASHRAE 62.1	(2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D 520	(2000; R 2005) Zinc Dust Pigment

ASTM F 1040	(1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA MG 1	(2009) Motors and Generators

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-5541	(2006; Rev F) Chemical Conversion Coatings on Aluminum and Aluminum Alloys

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50502	(Basic) Air Conditioners, (Unitary Heat Pump), Air to Air (3,000 to 300,000 BTU)
FS OO-A-374	(Rev C) Air Conditioners with Remote Condensing Units or Remote Air-Cooled, and Water-Cooled Condenser Units, Unitary

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

UNDERWRITERS LABORATORIES (UL)

UL 1995	(2005; R 2009) Heating and Cooling Equipment
UL 873	(2007; Reprint Jan 2010) Standard for Temperature-Indicating and -Regulating Equipment
UL 900	(2004; Reprint Nov 2009) Standard for Air Filter Units

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control system wiring diagrams

SD-03 Product Data

Condensing Units

Heat pumps, air to air

Air conditioners

Submit documentation for Energy Star qualifications or meeting FEMP requirements. Indicate Energy Efficiency Rating. For packaged terminal units, include indoor noise rating.

Filters

Thermostats

SD-06 Test Reports

Start-up and initial operational tests

SD-08 Manufacturer's Instructions

Heat pumps, air to air

Condensing Units

Air conditioners

Filters

Thermostats

SD-10 Operation and Maintenance Data

Condensing Units

Heat pumps, air to air,

Air conditioners,

Filters,

Thermostats,

Submit in accordance with DIVISION 01 - GENERAL REQUIREMENTS.

SD-11 Closeout Submittals

Posted operating instructions

1.4 QUALITY ASSURANCE

1.4.1 Modification of References

Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Contracting Officer.

1.4.2 Detail Drawing

For refrigerant piping, submit piping, including pipe sizes. Submit control system wiring diagrams.

1.4.3 Safety

Design, manufacture, and installation of unitary air conditioning equipment shall conform to ANSI/ASHRAE 15 & 34.

1.4.4 Posted Operating Instructions

Submit posted operating instructions for each packaged air conditioning unit.

1.4.5 Sizing

Size equipment based on Design Manual CS from the Air Conditioning Contractors of America; do not oversize.

1.5 REFRIGERANTS

Refrigerants shall have an Ozone Depletion Factor (ODF) of 0.05 or less. The ODF shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Programme. CFCs and HCFCs and Halons shall not be permitted. Refrigerant shall be an approved alternative refrigerant per EPA's Significant New Alternative Policy (SNAP) listing.

1.6 ENVIRONMENTAL REQUIREMENTS

For proper Indoor Environmental Quality, maintain positive pressure within the building. Ventilation shall meet or exceed ASHRAE 62.1 and all published addenda. Meet or exceed filter media efficiency as tested in accordance with ASHRAE 52.2. Thermal comfort shall meet or exceed ASHRAE 55.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Local/Regional Materials

See Division 01 - for Sustainable Design Requirements.

1.7.2 Environmental Data

See Division 01 for Environmental Requirements.

PART 2 PRODUCTS

2.1 CONDENSING UNITS

Each remote condenser coil shall be fitted with a manual isolation valve and an access valve on the coil side. Saturated refrigerant condensing temperature shall not exceed 120 degrees F at 95 degrees F ambient. Unit shall be provided with low ambient condenser controls to ensure proper operation in an ambient temperature of 0 degrees F. Fan and cabinet construction shall be provided as specified in paragraph "Unitary Equipment Components". Fan and condenser motors shall have open enclosed enclosures.

2.1.1 Energy Performance

Energy performance shall be in accordance with CID A-A-50502 and schedules on plans.

2.1.2 Air-Cooled Condenser

Unit shall be rated in accordance with ANSI/AHRI 460 and conform to the requirements of UL 1995. Unit shall be factory fabricated, tested, packaged, and self-contained. Unit shall be complete with casing, propeller or centrifugal type fans, heat rejection coils, connecting piping and wiring, and all necessary appurtenances.

2.1.2.1 Connections

Interconnecting refrigeration piping, electrical power, and control wiring between the condensing unit and the indoor unit shall be provided as required and as indicated. Electrical and refrigeration piping terminal connections between condensing unit and evaporator units shall be provided.

2.2 HEAT PUMPS, AIR TO AIR

CID A-A-50502, except as modified in this article; Type II, Class 18r2. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the ARI Directory, a letter of certification from ARI that the units have been certified and will be listed in the next Directory will be acceptable. Provide factory assembled units complete with accessories, wiring, piping, and controls. Provide units with outlet grilles, supplemental electric heaters, humidifiers, and air filters as specified in the paragraph entitled "Filters." Units shall be provided with low ambient operation condenser controls to ensure proper operation in an ambient temperature of 0 degrees F.

2.2.1 Energy Performance

Energy performance shall be in accordance with CID A-A-50502 schedules on plans.

2.2.2 Air Coils

Extended-surface fin and tube type with seamless copper or aluminum tubes with copper or aluminum fins securely bonded to the tubes. On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a coating on outdoor air and indoor air coils as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.2.3 Compressors

For compressors above 20 tons, compressor speed shall not exceed 3450 rpm. For equipment over 10 tons, provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have a means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shutdown by safety controls. Provide reciprocating compressors with crankcase heaters, and vibration isolators.

2.2.4 Mounting Provisions

Provide units that permit mounting as indicated. Provide suitable lifting attachment plates to enable equipment to be lifted to normal position.

2.2.5 Temperature Controls

Provide controls as specified in CID A-A-50502 and as modified herein. Provide indoor thermostats of the adjustable type that conform to applicable requirements of UL 873. Provide manual means for temperature set-back. Provide thermostats capable of controlling supplemental heat as specified in CID A-A-50502. Provide a manual selector switch or other means to permit the supplementary heater to be energized when the heat pump compressor and associated equipment are inoperative. Control supplementary heater with the room thermostat while bypassing the outdoor thermostat. Locate switch adjacent to or as an integral part of the room thermostat. An indicator light on the room thermostat or manual heat switch shall indicate when supplementary heaters are operating.

2.2.6 Accessories

In addition to accessories specified in CID A-A-50502, provide the following accessories for heat pump units.

a. Protective grille around outside unit coils

2.3 AIR CONDITIONERS

2.3.1 Split-System Type

FS OO-A-374, except as modified herein; Type I, Style A, B & C, Class 1. Additional requirements for various system components are specified in this paragraph; however, basic requirements for the system and system components

are contained in FS OO-A-374. Provide separate assemblies designed to be used together. Base ratings on the use of matched assemblies. Provide performance diagrams for units with capacities not certified by ARI to verify that components of the air conditioning system furnished will satisfy the capacity requirement specified or indicated. Minimum energy efficiency shall be in accordance with ASHRAE 90.1 - IP, at a minimum or in accordance with schedules on plans. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the ARI Directory, a letter of certification from ARI that units have been certified and will be listed in the next Directory will be acceptable. Provide capacity, electrical characteristics and operating conditions as indicated. Condensers shall provide not less than 10 degrees F liquid subcooling at standard ratings.

2.3.2 Single Zone Units

Provide single zone type units arranged to draw or blow through coil sections. Air may be blown or drawn through heating section.

2.3.3 Heaters

Provide as an integral part of the evaporator-blower unit.

2.3.4 Compressors

For compressors over 20 tons, compressor speed shall not exceed 3450 rpm. For systems over 10 tons provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multi- or variable speed compressors, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shut down by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes. Provide a pumpdown cycle for units 20 tons and over. Provide reciprocating compressors with crankcase heaters in accordance with the manufacturer's recommendations. If compressors are paralleled, provide not less than two independent circuits.

2.3.5 Coils

On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation. Provide a coating on condenser and evaporator coils and fins as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.3.6 Condenser Controls

Provide start-up and head pressure controls to allow for system operation at ambient temperatures down to 0 degrees F.

2.3.7 Fans

Provide belt-driven evaporator fans with adjustable pitch pulleys; except for units less than 5 ton capacity, direct drive with at least two speed taps may be used. Select pulleys at approximately midpoint of the adjustable range.

2.3.8 Filters

Provide filters of the type specified in this section.

2.3.9 Filter Boxes

Provide when filters are not included integral with air conditioning units. Construct of not less than No. 20 US gage steel with track, hinged access doors with latches, and gaskets between frame and filters. Arrange filters to filter outside and return air. Provide removable filter assemblies, replaceable without the use of tools.

2.3.10 Mixing Boxes

Provide of the physical size to match the basic unit and include equal sized flanged openings, sized to individually handle full air flow. Arrange openings as indicated. Provide openings with dampers of parallel or opposed blade type. Provide opposed blade type for modulating dampers and parallel type for two-position dampers. Connect damper shafts together by one continuous linkage bar. Arrange dampers for manual operation so that when one starts to close from its opened position, the other starts to open from its closed position.

2.3.11 Thermostats

Provide adjustable type that conforms to applicable requirements of UL 873. Provide combination heating-cooling type with contacts hermetically sealed against moisture, corrosion, lint, dust, and foreign material. Design to operate on not more than 1.5 degrees Fdifferential and of suitable range calibrated in degrees F. Provide adjustable heat anticipation and fixed cooling anticipation. Provide two independent temperature sensing elements electrically connected to control the compressor and heating equipment, respectively. Accomplish manual switching for system changeover from heating to cooling or cooling to heating and fan operation through the use of a thermostat subbase. Provide system selector switches to provide "COOL" and "OFF" and "HEAT" and fan selector switches to provide "AUTOMATIC" and "ON." Provide relays, contactors, and transformers located in a panel or panels for replacement and service.

2.3.11.1 Cooling

a. When thermostat is in "COOL" position with fan selector switch in "AUTO" position, compressor, evaporator fan, and condenser fan shall cycle together.

b. When thermostat is in "COOL" position with fan selector switch in "ON" position, compressor, and condenser fan shall cycle together and evaporator fan shall run continuously.

2.3.11.2 Heating

a. When thermostat is in "HEAT" position with fan selector switch in "AUTO" position, heater and supply air fan shall cycle together. Provide a separate thermostat to keep the fan running until the heater cools.

b. When thermostat is in "HEAT" position with fan selector switch in "ON" position, heater shall cycle and supply air fan shall run continuously.

2.3.11.3 Supply Air Fan

a. When fan selector switch is in "AUTO" position with thermostat in "OFF" position, fan shall not run.

b. When fan selector switch is in "ON" position, fan shall run continuously.

2.4 FILTERS

Provide filters to filter outside air and return air and locate inside air conditioners. Provide replaceable (throw-away) type. Filters shall conform to UL 900, Class 2. Polyurethane filters shall not be used on units with multiframe filters.

2.4.1 Replaceable Type Filters

ASTM F 1040 throw-away frames and media, standard dust holding capacity, 350 fpm maximum face velocity, and 2 inches thick. Filters shall have a minimum efficiency reporting value (MERV) of 8 when tested in accordance with ASHRAE 52.2.

2.5 FINISHES

2.5.1 Factory Coating

2.5.1.1 Equipment and Components

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 125 hours exposure to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type 1.

2.5.2 Chemical Conversion Coating with Polyelastomer Finish Coat

Dip coils in a chemical conversion solution to molecularly deposit a corrosion resistant coating by electrolysis action. Chemical conversion coatings shall conform to MIL-DTL-5541, Class 1A.Cure conversion coating at a temperature of 110 to 140 degrees F for a minimum of 3 hours. Coat coil surfaces with a complex polymer primer with a dry film thickness of 1 mil. Cure primer coat for a minimum of 1 hour. Using dip tank method, provide three coats of a complex polyelastomer finish coat. After each of the first two finish coats, cure the coils for 1 hour. Following the third

coat, spray a fog coat of an inert sealer on the coil surfaces. Total dry film thickness shall be 2.5 to 3.0 mils. Cure finish coat for a minimum of 3 hours. Coating materials shall have 300 percent flexibility, operate in temperatures of minus 50 to plus 220 degrees F, and protect against atmospheres of a pH range of 1 to 14.

2.6 MOTORS AND STARTERS

NEMA MG 1, NEMA ICS 1, and NEMA ICS 2. Variable speed. Motors less than 1 hp shall meet NEMA High Efficiency requirements. Motors 1 hp and larger shall meet NEMA Premium Efficiency requirements. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide general-purpose type starter enclosures in accordance with NEMA ICS 6.

2.7 REFRIGERANT PIPING

Refrigerant piping for split-system unitary equipment shall be provided and installed in accordance with Section 23 23 00 REFRIGERANT PIPING.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

3.1.1 Unitary Air Conditioning System

Install as indicated, in accordance with requirements of ANSI/ASHRAE 15 & 34, and the manufacturer's installation and operational instructions.

3.2 AUXILIARY DRAIN PANS, DRAIN CONNECTIONS, AND DRAIN LINES

Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment where condensate overflow will cause damage to ceilings, piping, and equipment below. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.3 ACCESS PANELS

Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.4 AIR FILTERS

Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air.

3.5 FLASHING AND PITCH POCKETS

Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls in accordance with Section 07 60 00 FLASHING AND SHEET METAL.

3.6 IDENTIFICATION TAGS AND PLATES

Provide equipment, gages, thermometers, valves, and controllers with tags numbered and stamped for their use. Provide plates and tags of brass or suitable nonferrous material, securely mounted or attached. Provide minimum letter and numeral size of 1/8 inch high.

3.7 FIELD QUALITY CONTROL

3.7.1 Start-Up and Initial Operational Tests

Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

3.7.2 Performance Tests

Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, test the systems to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, record readings hourly. At the end of the test period, average the readings, and the average shall be considered to be the system performance.

3.8 WASTE MANAGEMENT

Separate waste in accordance with the Waste Management Plan, placing copper materials in designated areas for reuse. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

-- End of Section --

SECTION 23 82 00.00 20

TERMINAL HEATING UNITS

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2006) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 54	(2006) National Fuel Gas Code
NFPA 70	(2007) National Electrical Code - 2008 Edition
NFPA 90A	(2002; Errata 2003; Errata 2005) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2006) Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	(2004) Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Unit heaters;

Infrared heaters;

SD-10 Operation and Maintenance Data

Unit heaters,

Infrared heaters

PART 2 PRODUCTS

2.1 UNIT HEATERS

Self-contained and factory assembled, propeller or centrifugal fan with capacities expressed as Btu per hour output and cubic foot-per-minute air delivery, operating conditions, and mounting arrangements as indicated. Average fan bearing life shall be minimum 200,000 hours at operating conditions. Provide fan motor with direct or belt drive. Construct fan-guard motor mount of steel wire. Equip each heater with individually adjustable package discharge louver. Provide thermostats as indicated. Furnish circuit breaker disconnect switch.

2.1.1 Electric Unit Heater

UL listed; wattage, voltage, phase, and number of steps as indicated. Provide control-circuit terminals and single source of power supply. Heater 5 Kw and larger shall be three-phase, with load balanced on each of the three phases. Limit leaving air temperature below 140 degrees F at 60 degrees F entering air.

2.1.1.1 Casing

Minimum 21 gage steel.

2.1.1.2 Heating Element

Nickel-chromium heating wire element, free from expansion noise and 60 Hz hum. Embed element in magnesium-oxide insulating refractory. Seal element in high-mass steel or corrosion-resisting metallic sheath with fins. Enclose element ends in terminal box. Space fins at maximum six fins per inch. Limit fin surface temperature 550 degrees Fat any point during normal operation.

2.1.1.3 Controls

Include limit controls for thermal overheat protection of heaters. For remote thermostatic operation, provide contactor rated for 100,000 duty cycles. Provide a control transformer to supply 120-volt thermostat control circuit for each heater. Provide room thermostat for pilot duty.

2.1.1.4 Wiring

Completely factory-prewired to terminal strips, ready to receive branch circuit and control connections for 140 degrees Faluminum wiring.

2.1.1.5 Accessories

Provide fan switching devices to independently operate fan motor for summer ventilation and winter heat recovery.

2.2 INFRARED HEATERS

Reflector-beam spread and operating conditions as indicated. Provide pre-wired control boxes, thermostats, reflector and duct hangers.

2.2.1 Electric Infrared Heater

Self-contained, factory assembled, and UL listed and including the heating element, reflector, heater housing, mounting brackets, element holders, wire guards, and high-temperature internal wiring.

2.2.1.1 Heating Element

Minimum 3/8 inch diameter quartz tube or metal sheath with coiled resistor wire. Element operating temperature range shall be 1200 to 1800 degrees F.

2.2.1.2 Heater Housing

Weatherproof stainless-steel construction. Provide a baked enamel finish over a corrosion-resistant primer. Provide a chrome-plated or stainless-steel wire guard to prevent heating elements from accidental damage. Furnish swivel brackets to position heater in any horizontal angle.

2.2.1.3 Reflector

Polished stainless steel.

2.2.1.4 Wiring

Fully enclosed internal wiring. Provide minimum 24 inchslack fixture (heater) wire for connection to branch circuit wiring.

2.3 SOURCE QUALITY CONTROL

Protect equipment items by manufacturers' corrosion-inhibiting coating or paint system that has proved capable of withstanding salt-spray test in accordance with ASTM B 117. Test indoor and outdoor equipment for 125 hours; test outdoor equipment used in a marine atmosphere for 500 hours. For each specimen, perform a scratch test as defined in ASTM D 1654.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment where indicated and as recommended by manufacturer's recommendations, NFPA 54, NFPA 90A, NFPA 90B, NFPA 91 and NFPA 211.

3.1.1 Suspensions of Equipment

Provide equipment supports including beam clamps, turnbuckles and twist links or weld-wire chains, wire ropes with rope clips and rope thimbles, threaded-eye rod hangers with lock nuts and heat-duct hangers, threaded-eye bolts with expansion screws, brackets, platform and mounting frame, and vibration isolators.Locate equipment in such a manner that working space is available for servicing, such as vacuum pump and burner removal, access to automatic controls, and lubrication. Provide electrical isolation of dissimilar metals. Clean interior of casings or cabinets before and after completion of installation.

3.1.2 Electrical Work

NFPA 70 and Division 16, "Electrical Work." When replacing original control wires, provide No. 16 AWG with minimum 105 degrees C insulation.

3.2 FIELD QUALITY CONTROL

Administer, schedule, and conduct specified tests. Furnish personnel, instruments and equipment for such tests. Correct defects and repeat the respective inspections and tests. Conduct inspections and testing in the presence of the Contracting Officer's Technical Representative.

3.2.1 Test Instruments and Apparatus

Provide instruments and apparatus currently certified as being accurate to within one percent of their full scale. Use gages with a maximum scale between 1 1/2 and 2 times test pressure.

3.2.2 Field Inspection

Prior to initial operation, inspect equipment installation to ensure that indicated and specified requirements have been met.

3.2.3 Field Tests

3.2.3.1 Insulation-Resistance Tests for Electrical Equipment

At the completion of wiring, test 600 volt wiring to verify that no short circuits exist before or after the attachment of electrical heating equipment to the power source. Make tests with an instrument which applies a voltage of approximately 500 volts for a direct reading of insulation resistance.

3.2.3.2 Operational Tests

After completing fire tests and insulation-resistance tests, operate equipment continuously under varying load conditions to verify functioning of combustion controls, electrical controls, flame safeguard controls, safety interlocks, and specified operating sequence. Run each test for a minimum period of one hour.

-- End of Section --

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. This section applies to all sections of Division 26, ELECTRICAL, of this project specification unless specified otherwise in the individual sections.This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM
Section 26 23 00 SWITCHBOARDS AND SWITCHGEAR
Section 26 51 00 INTERIOR LIGHTING
Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment

operations and that refer to this section for detailed description of submittal types.

c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 480/277 volts, three phase, four wire service to the main switchboard. The switchboard will supply the 480/277 volt distribution panelboards, which in turn supply dry type stepdown transformers and their associated 208/120 volt and 240/120 volt panelboards.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

When required by a task order, include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial

market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.

1.6.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

When required by a task order, provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.12 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in the task order, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the task order.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements specified in the technical sections.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS the section specifying the associated electrical equipment.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

-- End of Section --

26 08 16

COMMISSIONING OF ELECTRICAL SYSTEMS SUPPORT

PART 1 GENERAL

1.1 SCOPE OF ELECTRICAL SUPPORT

A. The purpose of this section is to specify Division 26, 27 and 28 responsibilities and participation in the commissioning process if commissioning services are specifically required by a task order.

B. The Owner has established a Commissioning Authority (CxA) to oversee certain commissioning activities on this project. While the CxA has the overall responsibility for planning and coordinating the commissioning process, all parties participate. This includes the owner, construction manager, facility operator, architect, engineer, general contractor, subcontractors, specialty subcontractors, equipment suppliers, vendors, building authorities and others entities as required.

C. If required by a task order, the General Contractor and all Subcontractors shall designate one person to represent their own company as the full-time Lead Commissioning Coordinator. Each Lead Commissioning Coordinator shall participate as a member of the Commissioning Authority's 'Commissioning Team'. The General Contractor and each Subcontractor shall also designate a backup person to represent their company and fill the role as Lead Commissioning Coordinator and participate as a member of the CxA Commissioning Team when there are absences.

D. Commissioning and coordination with the Commissioning Authority are the responsibility of the Contractor (including subcontractors and vendors). The Contractor is responsible for providing all scheduling, coordination and support required for start-up, testing, and commissioning (see Division 01). The General Commissioning Requirements Section 01 19 13 is intended to provide an indication of the systems which are to be commissioned by the Contractor prior to and including verification by the Owner's Representative. The commissioning process requires Division 26, 27 and 28 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner.

E. Work of Divisions 26, 27, and 28 include the following:

1. Attend commissioning scoping meetings. Equipment vendor representatives shall also attend upon request of the Commissioning Authority. These meetings shall further define the testing requirements and participation of each contractor and sub-contractors for each commissioning activity.

2. Attend commissioning meetings as required to facilitate the commissioning process.

3. Provide Commissioning Authority additional requested data, prior to normal O&M Manual submittal, in a timely manner for the development of the pre-functional and functional performance testing procedures.

4. During the normal submittal processes, provide an additional copy of all equipment submittals, startup forms, field static testing reports (Circuit breaker test report, Megger test reports, Torque testing reports, etc.) to the Commissioning Authority for review.

5. The Electrical Prime Contractor shall be responsible for development of a comprehensive startup plan. The startup plan shall be developed with the help of the Commissioning Authority in order to integrate startup activities with the Commissioning Authority's commissioning plan.

6. The Commissioning Authority shall prepare the Pre-Functional Checklists (PFC) and Functional Performance Test (FPT) checklists. The PFC & FPT checklists shall be completed after equipment submittals have been reviewed, and then distributed the Contractor.

7. Provide skilled technicians, including equipment vendor representatives, equipment, and materials to perform pre-functional testing and execute functional performance tests.

8. Correct deficiencies found during startup and functional performance testing in a timely manner to facilitate retesting activities within the commissioning schedule.

9. Submit the completed Pre-Functional Checklists to General Contractor, and Commissioning Authority to verify pre-functional requirements are fulfilled before functional performance testing for the associated equipment or system is scheduled to start. Refer to Section "01 91 13 - General Commissioning Requirements," for commissioning procedure detail. Startup documentation shall also be required from as a prerequisite to functional performance testing.

10. Maintain and update as-built drawings during construction.

11. Provide final O&M manuals that incorporate all system changes.

12. Providing training, for equipment and systems specified under this section, with coordination by the Contractor and Owner's Representative

1.2 RELATED WORK

A. Division 01 Section 01 91 13 General Commissioning Requirements.

B. Division 26 Electrical.

C. Division 27 Communications

D. Cooperate with the Mechanical contractor in the following manner:

1. Provide necessary power to allow mechanical equipment start up to be accomplished according to the master schedule.

2. Provide labor and material to make corrections when required, without undue delay.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide test equipment as necessary for start-up and commissioning of the electrical equipment and systems.

B. Proprietary test equipment required by the electrical equipment manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall demonstrate its use and assist the Contractor in the commissioning process.

PART 3 EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so each system can be started, tested, and otherwise commissioned. Division 28 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are fully functional. This includes the complete installation of all equipment, materials, conduit, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.

B. A commissioning plan will be developed by the Commissioning Authority and approved by the Owner's Representative.

1. Division 28 shall be obligated to assist the Commissioning Authority in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation, identification of electrical commissioning support person, parties responsible for startup activities, and schedule dates for equipment startup activities.

2. If system modifications/clarifications are called for in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.

3. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner's Representative for approval.

3.2 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up all systems within Division 28.

1. These same technicians shall be made available to assist the Contractor and Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty.

2. Work schedules, time required for testing, etc., will be requested and coordinated by the Contractor.

3. Division 28 will ensure that qualified technician(s) are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustment, and problem resolutions.

B. System problems and discrepancies may require additional technician time which shall be made available for the subsequent commissioning periods until required system performance is obtained.

C. The Owner's Representative reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Such qualifications include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Contractor to get the job done.

3.3 WORK TO RESOLVE DEFICIENCIES

A. In some systems, misadjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Owner's Representative and the Architect, with input from the Contractor and equipment supplier. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the work needed to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problem in an expeditious manner will be the Contractor's responsibility.

3.4 RETESTING AND RECOMMISSIONING

Any fault in material or in any part of the installation revealed by commissioning tests shall be investigated, replaced, or repaired by the Contractor, and the same test repeated at the Contractor's expense until no fault appears.

3.5 TRAINING

A. Participate in the training of the Owner's engineering and maintenance staff, as required in Divisions 01 and 28, on each system and related components. Training, in part, will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.

B. Training shall be conducted jointly by the Contractor, the Design Engineers, and the equipment vendors. The Contractor will be responsible for highlighting system peculiarities specific to this project.

-- End of Section --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012) National Electrical Safety Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2005) American National Standard for Electrical Metallic Tubing (EMT)
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FU 1	(2002; R 2007) Low Voltage Cartridge Fuses

NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2010) Terminal Blocks
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2009) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(1992; R 1997) Standard for Dry-Type Transformers for General Applications
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2004) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA TP 1	(2002) Guide for Determining Energy Efficiency for Distribution Transformers
NEMA VE 1	(2009) Standard for Metal Cable Tray Systems
NEMA WD 1	(1999; R 2005; R 2010) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2002; R 2008) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2007; Errata 2007) American National Standard for Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

NFPA 70E	(2012) Standard for Electrical Safety in the Workplace
NFPA 780	(2011) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA J-STD-607	(2002a) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
TIA-568-C.1	(2009) Commercial Building Telecommunications Cabling Standard
TIA-569	(2004b; Add 1 2009) Commercial Building Standard for Telecommunications Pathways and Spaces

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Jul 2007) Standard for Flexible Metal Conduit
UL 1063	(2006) Machine-Tool Wires and Cables
UL 1242	(2006; Reprint Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1449	(2006; Reprint Feb 2011) Surge Protective Devices
UL 1561	(2011) Dry-Type General Purpose and Power Transformers
UL 1569	(1999; Reprint Jun 2009) Standard for Metal-Clad Cables
UL 198M	(2003; Reprint Oct 2007) Standard for Mine-Duty Fuses
UL 20	(2010) General-Use Snap Switches
UL 2043	(2008) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 360	(2009; Reprint Jun 2009) Liquid-Tight Flexible Steel Conduit

UL 4248	(2007) UL Standard for Safety Fuseholders
UL 44	(2010) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2003; Reprint Feb 2010) Wire Connectors
UL 486C	(2004; Reprint Feb 2010) Splicing Wire Connectors
UL 489	(2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2001; Reprint Apr 2010) Attachment Plugs and Receptacles
UL 5	(2004; Reprint Jul 2010) Surface Metal Raceways and Fittings
UL 50	(2007) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 508	(1999; Reprint Apr 2010) Industrial Control Equipment
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2004; Reprint Apr 2010) Metallic Outlet Boxes
UL 514B	(2004; Reprint Nov 2009) Conduit, Tubing and Cable Fittings
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 651	(2005; Reprint Mar 2010) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 67	(2009; Reprint Sep 2010) Standard for Panelboards
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 817	(2001; Reprint Oct 2009) Standard for Cord Sets and Power-Supply Cords

UL 83	(2008) Thermoplastic-Insulated Wires and Cables
UL 870	(2008) Standard for Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2006; Reprint May 2010) Ground-Fault Circuit-Interrupters
UL 96A	(2007) Standard for Installation Requirements for Lightning Protection Systems
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards

Transformers;

Cable trays;

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

Wireways;

SD-03 Product Data

Receptacles;

Circuit breakers;

Switches;

Transformers;

Enclosed circuit breakers;

Motor controllers Combination

motor controller;

Manual motor starters;

CATV outlets;

Telecommunications Grounding Busbar;

Surge protective devices;

Submittals shall include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test;

Grounding system test;

Transformer tests;

Ground-fault receptacle test;

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2,UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40(40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Steel compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.3 SURFACE RACEWAY

2.3.1 Surface Metal Raceway

UL 5, two-piece painted steel, totally enclosed, snap-cover type. Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Receptacles shall be as specified herein and shall be spaced minimum of one every 18 inches.

2.4 CABLE TRAYS

NEMA VE 1. Cable trays shall form a wireway system, and shall be of nominal 3 inch depth. Cable trays shall be constructed of aluminum, copper-free aluminum or steel that has been zinc-coated after fabrication. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius.

2.4.1 Basket-Type Cable Trays

Provide size as indicated with maximum wire mesh spacing of 2 by 4 inch.

2.4.2 Cantilever

Cantilever-type, center-hung cable trays may be provided at the Contractor's option in lieu of other cable tray types specified.

2.5 OPEN TELECOMMUNICATIONS CABLE SUPPORT

2.5.1 Open Top Cable Supports

Provide open top cable supports in accordance with UL 2043. Open top cable supports shall be galvanized or zinc-coated steel.

2.5.2 Closed Ring Cable Supports

Provide closed ring cable supports in accordance with UL 2043. Closed ring cable supports shall be steel.

2.6 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.6.1 Outlet Boxes for Telecommunications System

Provide standard type 4 11/16 inches square by 2 1/4 inches deep. Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend radii.

2.7 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.8 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.8.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and capacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.8.1.1 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.8.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

2.8.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.8.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.8.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with TIA J-STD-607. The TBB shall be a minimum No. 6 AWG and be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG. 2.8.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the telecommunications main grounding busbar (TMGB) and the electrical service ground in accordance with TIA J-STD-607. The bonding conductor for telecommunications shall be sized the same as the TBB.

2.8.5 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.8.6 Cable Tray Cable or Power Limited Tray Cable

UL listed; type TC or PLTC.

2.8.7 Cord Sets and Power-Supply Cords

UL 817.

2.9 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.10 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Plates on finished walls shall be nylon or lexan, minimum 0.03 inch wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.11 SWITCHES

2.11.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Handles shall be ivory thermoplastic. Wiring terminals shall be screw-type, side-wired or of the solderless pressure type having suitable conductor-release arrangement. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.11.2 Switch with Red Pilot Handle

NEMA WD 1. Provide pilot lights that are integrally constructed as a part of the switch's handle. The pilot light shall be red and shall illuminate whenever the switch is closed or "on". The pilot lighted switch shall be rated 20 amps and 120 volts or 277 volts as indicated. Provide the circuit's neutral conductor to each switch with a pilot light.

2.11.3 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

2.11.4 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 1, enclosure or as indicated, per NEMA ICS 6.

2.12 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch . Time-current characteristics curves of fuses serving motors or connected in

series with circuit breakers shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

2.12.1 Fuseholders

Provide in accordance with UL 4248.

2.12.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 198M, Class RK-1 or RK-5. Associated fuseholders shall be Class R only.

2.12.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 198M, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.12.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 198M, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.13 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory as per NEMA WD 1. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double or triple-wipe ground contacts.

2.13.1 Switched Duplex Receptacles

Provide separate terminals for each ungrounded pole. Top receptacle shall be switched when installed.

2.13.2 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

2.13.3 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFCI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.13.4 Special Purpose Receptacles

Provide in NEMA configuration indicated. Furnish one matching plug with each receptacle.

2.13.5 Plugs

Provide heavy-duty, rubber-covered three-wire cord of required size, install plugs thereon, and attach to equipment. Plugs shall be UL listed with receptacles, complete with grounding blades. Where equipment is not available, turn over plugs and cord assemblies to the Government.

2.14 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards shall be circuit breaker-equipped unless indicated otherwise. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" or "below" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Provide new directories for existing panels modified by this project as indicated. Type directories and mount in holder behind transparent protective covering. Panelboard shall have nameplates in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.14.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gauge if flush-mounted or mounted outdoors, and not less than No. 12 gauge if surface-mounted indoors, with full seam-welded box ends. Cabinets shall be painted in accordance with paragraph PAINTING. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch. Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets.

2.14.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.14.2.1 Panelboard Neutrals for Non-Linear Loads

UL listed, and panelboard type shall have been specifically UL heat rise tested for use on non-linear loads. Panelboard shall be heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing. Verification of the testing procedure shall be provided upon request. Two neutral assemblies paralleled together with cable is not acceptable. Nameplates for panelboard rated for use on non-linear loads shall be marked "SUITABLE FOR NON-LINEAR LOADS"and shall be in accordance with paragraph FIELD FABRICATED NAMEPLATES. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.14.3 Circuit Breakers

Shall be as specified in Section 26 28 01.00 COORDINATED POWER SYSTEM PROTECTION.

2.15 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

2.16 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs); shall conform to UL 508 and UL 489 and shall be provided as shown. MSCPs shall consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. MSCPs shall be rated in accordance with the requirements of NFPA 70.

2.17 TRANSFORMERS

NEMA ST 20, general purpose, dry-type, self-cooled, ventilated. Provide transformers in NEMA 1 enclosure. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 115 degrees C temperature rise shall be capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.17.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, shall be energy efficient type. Minimum efficiency, based on factory test results, shall not be less than NEMA Class 1 efficiency as defined by NEMA TP 1.

2.17.2 Transformers With Non-Linear Loads

Transformer insulation shall be a UL recognized 220 degrees C system. Neither the primary nor the secondary temperature shall exceed 220 degrees C at any point in the coils while carrying their full rating of non-sinusoidal load. Transformers are to be UL listed and labeled for K-9 in accordance with UL 1561. Transformers evaluated by the UL K-Factor evaluation shall be listed for 115 degrees C average temperature rise only. Transformers with K-Factor ratings with temperature rise of 150 degrees C rise shall not be acceptable. K-Factor rated transformers shall have an impedance range of 3 percent to 5 percent, and shall have a minimum reactance of 2 percent to prevent excessive neutral current when supplying loads with large amounts of third harmonic.

2.18 MOTORS

NEMA MG 1; hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Unless otherwise indicated, motors rated 1 HP and above shall be continuous duty type.

Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.18.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.18.2 Premium Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10. In addition, continuous rated, polyphase squirrel-cage medium induction motors shall meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.18.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-

loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.18.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment as specified herein. Power wiring and conduit shall conform to the requirements specified herein. Control wiring shall be provided under, and conform to the requirements of the section specifying the associated equipment.

2.19 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position. Minimum short circuit withstand rating of combination motor controller shall match electrical equipment feeding controller.

2.19.1 Control Wiring

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual

conductors of each external cable to be terminated on adjacent terminal points.

2.19.2 Control Circuit Terminal Blocks

NEMA ICS 4.Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.19.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.19.3 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder. One secondary lead shall be fused; other shall be grounded.

2.19.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.19.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers shall have compelling relays and shall be multiple-button, station-type with pilot lights for each speed.

2.19.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

2.19.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.19.8 Reduced-Voltage Controllers

Provide for polyphase motors where indicated. Reduced-voltage starters shall be single-step, closed transition autotransformer or solid state-type, or as indicated, and shall have adjustable time interval between application of reduced and full voltages to motors.

2.20 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Designed for surface mounting with overload protection and pilot lights.

2.20.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color shall be in accordance with NEMA ICS 2. Jewels for use with switches controlling motors shall be green; jewels for other purposes shall be white.

2.21 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 23, "Mechanical."

2.22 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires, cable trays, and other accessories for telecommunications outlets and pathway in accordance with TIA-569 and as specified herein. Additional telecommunications requirements are specified in Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.23 COMMUNITY ANTENNA TELEVISION (CATV) SYSTEM

CATV Outlets

Provide flush mounted, 75-ohm, F-type connector outlet rated from 5 to 1000 MHz in standard electrical outlet boxes with mounting frame.

2.23.2 CATV Faceplates

Provide modular faceplates for mounting of CATV Outlets. Faceplate color shall match outlet and switch coverplates.

2.23.3 Backboards

Provide void-free, fire rated interior grade plywood, 3/4 inch thick, 4 by 8 feet. Do not cover the fire stamp on the backboard.

2.24 GROUNDING AND BONDING EQUIPMENT

2.24.1 Ground Rods

UL 467. Ground rods shall be sectional type, copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.24.2 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated.

2.24.3 Telecommunications and CATV Grounding Busbar

Provide corrosion-resistant grounding busbar suitable for indoor installation in accordance with TIA J-STD-607. Busbars shall be plated for reduced contact resistance. If not plated, the busbar shall be cleaned prior to fastening the conductors to the busbar, and an anti-oxidant shall be applied to the contact area to control corrosion and reduce contact resistance. Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility and a (TGB) in all other telecommunications rooms and equipment rooms. The telecommunications main grounding busbar (TMGB) and the telecommunications grounding busbar (TGB) shall be sized in accordance with the immediate application requirements and with consideration of future growth. Provide telecommunications grounding busbars with the following:

a. Predrilled copper busbar provided with holes for use with standard sized lugs;

b. Minimum dimensions of 0.25 in thick by and <MET>50 mm</MET>2 in wide for TGBs with minimum length;

c. Listed by a nationally recognized testing laboratory.

2.25 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.26 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when

applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.27 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.28 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00, FIRESTOPPING.

2.29 WIREWAYS

UL 870. Material shall be steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with hinged-cover NEMA 1 enclosure per NEMA ICS 6.

2.30 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices which comply with UL 1449 at the service entrance, switchboard, and at panelboards where noted. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
Each phase to neutral (L-N)
Neutral to ground (N-G)
Phase to ground (L-G)

Surge protective devices shall have a minimum surge current rating of 80,000 amperes per mode minimum and 160,000 amperes per phase minimum.

The minimum MCOV (Maximum Continuous Operating Voltage) rating shall be:

300/150V for 120/240V, single phase system
300/150V for 208Y/120V, three phase system
600/320V for 480Y/277V, three phase system

EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

The UL 1449 3rd Edition Voltage Protection Ratings "VPR" (6kV, 3000 Amps, 8/20 microseconds waveform) shall not exceed the system voltage ratings as follows:

208/120V and 240/120V
Line to Neutral, 900V
Line to Ground, 900V
Neutral to Ground, 900V
Line to Line, 1200V

480/277V System
Line to Neutral, 1200V
Line to Ground, 1200V
Neutral to Ground, 1200V
Line to Line, 2000V

The SPD shall have a minimum UL 1449 3rd Edition Nominal Discharge Current Rating (In) of 10,000 Amps.

Surge protective devices shall be compatible with a lightning protection system and meet the requirements of UL 96A.

2.31 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray, and equipment located outdoors shall be ANSI Light Gray or Dark Gray. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or

specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be firestopped in accordance with Section 07 84 00, FIRESTOPPING.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.3.2 Metal Clad Cable

Install in accordance with NFPA 70, Type MC cable.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits in crawl space under floor as if exposed.

3.1.4.1 Restrictions Applicable to EMT

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.

d. Do not use in hazardous areas.

e. Do not use outdoors.

f. Do not use in fire pump rooms.

g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40 and PVC Schedule 80

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms,

electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in fire pump rooms.

(4) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

(5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

(6) Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.3 Restrictions Applicable to MC Cabling

MC Cable may only be used where approved in advance by the Contract Officer and the Project Engineer.

3.1.4.4 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.5 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 18 inches below slab or grade.

3.1.4.6 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40. Convert nonmetallic conduit to plastic-coated rigid, or IMC steel conduit before rising through floor slab. Plastic coating shall extend minimum 6 inches above floor.

3.1.4.7 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.4.8 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

3.1.4.9 Conduit Installed in Concrete Floor Slabs

Rigid steel; steel IMC; or PVC, Type EPC-40. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Increase slab

thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings shall allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab. Where nonmetallic conduit is used, raceway shall be converted to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

3.1.4.10 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.11 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.12 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.13 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.14 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.4.15 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with TIA-569.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room shall be installed and cabling length requirements in accordance with TIA-568-C.1. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling) shall be installed in accordance with TIA-569. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated. 3.1.4.16 Community Antenna Television (CATV) System Conduits

Install a system of CATV wire-supporting structures (pathway), including: outlet boxes, conduits wireways, cable trays, and other accessories for CATV outlets and pathway in accordance with TIA-569. Distribution system shall be star topology from each outlet box to the telecommunications room.

3.1.5 Cable Tray Installation

Install and ground in accordance with NFPA 70. In addition, install and ground telecommunications cable tray in accordance with TIA-569, and TIA J-STD-607. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Support in accordance with manufacturer recommendations but at not more than 10 foot intervals. Contact surfaces of aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. For grounding of cable tray system provide No. 2 AWG bare copper wire throughout cable tray system, and bond to each section, except use No. 1/0 aluminum wire if cable tray is aluminum. Terminate cable trays 10 inches from both sides of smoke and fire partitions. Conductors run through smoke and fire partitions shall be installed in 4 inch rigid steel conduits with grounding bushings, extending 12 inches beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. Penetrations shall be firestopped in accordance with Section 07 84 00, FIRESTOPPING.

Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.6 Telecommunications Cable Support Installation

Install open top and closed ring cable supports on 4 ft to 5 ft centers to adequately support and distribute the cable's weight. These types of supports shall be used to support a maximum of 50 0.25 in diameter cables. Install suspended cables with at least 3 in of clear vertical space above the ceiling tiles and support channels (T-bars). Open top and closed ring cable supports shall be suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.

3.1.7 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, and when specifically indicated. Boxes in other locations shall be sheet steel, except that nonmetallic boxes may be used with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces.Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.7.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets shall be a minimum of 4 11/16 inches square by 2 1/4 inches deep. Mount outlet boxes flush in finished walls.

3.1.7.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, and compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.7.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.

3.1.8 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches and handicapped telecommunications stations 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet.

3.1.9 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.9.1 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.10 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.11 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.12 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.13 Grounding and Bonding

Provide In accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This shall include lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Interconnection to the gas line shall be made on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA J-STD-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.13.1 Ground Rods

Provide cone pointed ground rods. The resistance to ground shall be measured using the fall-of-potential method described in IEEE 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 10 feet on centers, shall be driven with the first rod. Until the resultant resistance does not exceed 25 ohms measured not less than 48 hours after rainfall.

3.1.13.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.13.3 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated. Transformer neutrals and electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to the entrance ground. Connections and splices shall be of the bolted type.

3.1.13.4 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.13.5 Telecommunications System

Provide telecommunications grounding in accordance with the following:

a. Telecommunications Grounding Busbars: Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility.Provide a telecommunications grounding busbar (TGB) in all other telecommunications rooms and telecommunications equipment rooms. The TGB shall be as close to the telecommunications room panelboard as practicable, when equipped. Where a panelboard for telecommunications equipment is not installed in the telecommunications room, the TGB shall be located near the backbone cabling and associated terminations. In addition, the TGB shall be placed to provide for the shortest and straightest routing of the grounding conductors. Where a panelboard for telecommunications equipment is located within the same room or space as a TGB, that panelboard’s alternating current equipment ground (ACEG) bus (when equipped) or the panelboard enclosure shall be bonded to the TGB. Telecommunications grounding busbars shall be installed to maintain clearances as required by NFPA 70 and shall be insulated from its support. A minimum of 2 inches separation from the wall is recommended to allow access to the rear of the busbar and the mounting height shall be adjusted to accommodate overhead or underfloor cable routing.

b. Telecommunications Bonding Conductors: Provide main telecommunications service equipment ground consisting of separate bonding conductor for telecommunications, between the TMGB and readily accessible grounding connection of the electrical service. Grounding and bonding conductors

should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum. Provide a telecommunications bonding backbone (TBB) that originates at the TMGB extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. The TBB conductors shall be installed and protected from physical and mechanical damage. The TBB conductors should be installed without splices and routed in the shortest possible straight-line path. The bonding conductor between a TBB and a TGB shall be continuous. Where splices are necessary, the number of splices should be a minimum and they shall be accessible and located in telecommunications spaces. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors, or equivalent. All joints shall be adequately supported and protected from damage. The TBB and GE shall not be connected to the pathway ground, except at the TMGB or the TGB.

c. Telecommunications Grounding Connections: Telecommunications grounding connections to the TMGB or TGB shall utilize listed compression two-hole lugs, exothermic welding, suitable and equivalent one hole non-twisting lugs, or other irreversible compression type connections. All metallic pathways, cabinets, and racks for telecommunications cabling and interconnecting hardware located within the same room or space as the TMGB or TGB shall be bonded to the TMGB or TGB respectively. In a metal frame (structural steel) building, where the steel framework is readily accessible within the room; each TMGB and TGB shall be bonded to the vertical steel metal frame using a minimum No. 6 AWG conductor. Where the metal frame is external to the room and readily accessible, the metal frame shall be bonded to the TGB or TMGB with a minimum No. 6 AWG conductor. When practicable because of shorter distances and, where horizontal steel members are permanently electrically bonded to vertical column members, the TGB may be bonded to these horizontal members in lieu of the vertical column members. All connectors used for bonding to the metal frame of a building shall be listed for the intended purpose.

3.1.14 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.1.15 Not used

3.1.16 Government-Furnished Equipment

Contractor shall rough-in for Government-furnished equipment and shall make connections to Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

3.1.17 Demolition of Existing Work

Demolition of existing electrical distribution systems shall be performed as follows:

3.1.17.1 Existing Concealed Wiring to be Removed

Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.17.2 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment shall include equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, as indicated.

3.1.18 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 26 23 00

SWITCHBOARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM D1535	(2008e1) Specifying Color by the Munsell System
ASTM D709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012) National Electrical Safety Code
IEEE C37.90.1	(2002; Errata 2003; Errata 2004) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C57.12.28	(2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity

IEEE C57.13	(2008) Standard Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.1	(2008) Electric Meters Code for Electricity Metering
ANSI/NEMA PB 2.1	(2007) General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA LI 1	(1998) Industrial Laminating Thermosetting Products
NEMA PB 2	(2006) Deadfront Distribution Switchboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 489	(2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 891	(2005) Switchboards

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchboard Drawings;

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control

panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

SD-03 Product Data

Switchboard;

SD-06 Test Reports

Acceptance checks and tests;

SD-10 Operation and Maintenance Data

Switchboard Operation and Maintenance, Data Package 5;

SD-11 Closeout Submittals

Assembled Operation and Maintenance Manuals;

Equipment Test Schedule;

Request for Settings;

1.4 QUALITY ASSURANCE

1.4.1 Switchboard Product Data

Each submittal shall include manufacturer's information for each component, device and accessory provided with the switchboard including:

a. Circuit breaker type, interrupting rating, and trip devices, including available settings

b. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device.

1.4.2 Switchboard Drawings

Drawings shall include, but are not limited to the following:

a. One-line diagram including breakers, fuses, current transformers, and meters

b. Outline drawings including front elevation, section views, footprint, and overall dimensions

c. Bus configuration including dimensions and ampere ratings of bus bars

d. Markings and NEMA nameplate data, including fuse information (manufacturer's name, catalog number, and ratings)

e. Circuit breaker type, interrupting rating, and trip devices, including available settings

f. Three-line diagrams and elementary diagrams and wiring diagrams with terminals identified, and indicating prewired interconnections between items of equipment and the interconnection between the items.

g. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device. These shall be used by the designer of record to provide breaker settings that will ensure protection and coordination are achieved.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 MAINTENANCE

1.5.1 Switchboard Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with DIVISION 01 GENERAL REQUIREMENTS.

1.5.2 Assembled Operation and Maintenance Manuals

Manuals shall be assembled and bound securely in durable, hard covered, water resistant binders. The manuals shall be assembled and indexed in the following order with a table of contents. The contents of the assembled operation and maintenance manuals shall be as follows:

a. Manufacturer's O&M information required by the paragraph entitled "SD-10, Operation and Maintenance Data".

b. Catalog data required by the paragraph entitled, "SD-03, Product Data".

c. Drawings required by the paragraph entitled, "SD-02, Shop Drawings".

d. Spare parts and supply list.

e. Information on metering

f. Design test reports

g. Production test reports

1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be switchboards or related accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.2 SWITCHBOARD

NEMA PB 2 and UL 891.

2.2.1 Ratings

The voltage rating of the switchboard shall be 480Y/277 volts AC, 4-wire 3 phase. The continuous current rating of the main bus shall be as indicated. The short-circuit current rating shall be as indicated. The switchboard shall be UL listed and labeled as service entrance equipment.

2.2.2 Construction

Switchboard shall consist of vertical sections bolted together to form a rigid assembly and shall be front aligned. All circuit breakers shall be front accessible. Where indicated, "space for future" or "space" shall mean to include bus, device supports, and connections. Provide insulating barriers in accordance with NEMA LI 1, Type GPO-3, 0.25 inch minimum

thickness. Apply moisture resistant coating to all rough-cut edges of barriers. Switchboard shall be completely factory engineered and assembled, including protective devices and equipment indicated with necessary interconnections, instrumentation, and control wiring.

2.2.2.1 Enclosure

The switchboard enclosure shall be a NEMA ICS 6 Type 1. Enclosure shall be bolted together with removable bolt-on side and rear covers. Bases, frames and channels of enclosure shall be corrosion resistant and shall be fabricated of or galvanized steel. Base shall include any part of enclosure that is within 3 inches of concrete pad. Galvanized steel shall be ASTM A123/A123M, ASTM A653/A653M G90 coating, and ASTM A153/A153M, as applicable. Galvanize after fabrication where practicable. Paint enclosure, including bases, ASTM D1535 light gray No. 61 or No. 49. Paint coating system shall comply with IEEE C57.12.28 for galvanized steel.

2.2.2.2 Bus Bars

Bus bars shall be copper with silver-plated contact surfaces or aluminum with tin-plated contact surfaces. Plating shall be a minimum of 0.0002 inch thick. Make bus connections and joints with hardened steel bolts. The through-bus shall be rated at the full ampacity of the main throughout the switchboard. Provide minimum one-quarter by 2 inch copper ground bus secured to each vertical section along the entire length of the switchboard. The neutral bus shall be rated 100 percent of the main bus continuous current rating.

2.2.2.3 Main Section

The main section shall consist of an individually mounted molded-case, electronic circuit breaker.

2.2.2.4 Distribution Sections

The distribution section shall consist of molded-case circuit breakers as indicated.

2.2.2.5 Handles

Handles for individually mounted devices shall be of the same design and method of external operation. Label handles prominently to indicate device ampere rating, color coded for device type. Identify ON-OFF indication by handle position and by prominent marking.

2.2.3 Protective Device

Provide main and branch protective devices as indicated.

2.2.3.1 Molded-Case Circuit Breaker

UL 489. UL listed and labeled, 100 percent rated, stationary, manually operated, low voltage molded-case circuit breaker, with a short-circuit current rating of as indicated. Breaker frame size shall be as indicated. Series rated circuit breakers are unacceptable.

2.2.4 Electronic Trip Units

Equip main and distribution breakers as indicated with a solid-state tripping system consisting of three current sensors and a microprocessor-based trip unit that will provide true rms sensing adjustable time-current circuit protection. The ampere rating of the current sensors shall be as indicated. The trip unit ampere rating shall be as indicated. Ground fault protection shall be zero sequence sensing. The electronic trip units shall have the features as indicated.

2.2.5 Watthour and Digital Meters

2.2.5.1 Digital Meters

IEEE C37.90.1 for surge withstand. Provide true rms, plus/minus one percent accuracy, programmable, microprocessor-based meter enclosed in sealed cases with a simultaneous three line, twelve value LED display. Meters shall have 0.56 inch, minimum, LEDs. The meters shall accept input from standard 5A secondary instrument transformers and direct voltage monitoring range to 600 volts, phase to phase. Programming shall be via a front panel display and a communication interface with a computer. Password secured programming shall be stored in non-volatile EEPROM memory. Digital communications shall be Modbus RTU protocol via a RS485 serial port. The meter shall calculate and store average max/min demand values for all readings based on a user selectable sliding window averaging period. The meter shall have programmable hi/low set limits with two Form C dry contact relays when exceeding alarm conditions. Meter shall provide Total Harmonic Distortion (THD) measurement to the thirty-first order. Historical trend logging capability shall include ability to store up to 100,000 data points with intervals of 1 second to 180 minutes. The unit shall also store and time stamp up to 100 programmable triggered conditions. Event waveform recording shall be triggered by the rms of 2 cycles of voltage or current exceeding programmable set points.Waveforms shall be stored for all 6 channels of voltage and current for a minimum of 10 cycles prior to the event and 50 cycles past the event.

a. Multi-Function Meter: Meter shall simultaneously display a selected phase to neutral voltage, phase to phase voltage, percent phase to neutral voltage THD, percent phase to phase voltage THD; a selected phase current, neutral current, percent phase current THD, percent neutral current; selected total PF, kW, KVA, kVAR, FREQ, kVAh, kWh. Detected alarm conditions include over/under current, over/under voltage, over/under KVA, over/under frequency, over/under selected PF/kVAR, voltage phase reversal, voltage imbalance, reverse power, over percent THD. The meter shall have a Form C KYZ pulse output relay.

2.2.6 Current Transformers

CT Ratio	RF	Accuracy Class
200/5	4.0	0.3 thru B-0.1
300/5	3.0	0.3 thru B-0.2
400/5	4.0	0.3 thru B-0.2

600/5	4.0	0.3 thru B-0.5
800/5	2.0	0.3 thru B-0.5
1200/5	1.5	0.3 thru B-0.5
1500/5	1.5	0.3 thru B-0.9
2000/5	1.5	0.3 thru B-1.8

IEEE C57.13. Transformers shall be single ratio, 60 hertz, 2000 to 5-ampere ratio, 1.5 rating factor, with a metering accuracy class of 0.3 through B-1.8.

2.2.7 Meter Fusing

Provide a fuse block mounted in the metering compartment containing one fuse per phase to protect the voltage input to voltage sensing meters. Size fuses as recommended by the meter manufacturer.

2.2.8 Terminal Boards

Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Terminal boards associated with current transformers shall be short-circuiting type. Terminate conductors for current transformers with ring-tongue lugs. Terminal board identification shall be identical in similar units. External wiring shall be color coded consistently for similar terminal boards.

2.2.9 Wire Marking

Mark control and metering conductors at each end. Provide factory-installed, white, plastic tubing, heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide white, preprinted, polyvinyl chloride (PVC) sleeves, heat stamped with black block type letters. Each sleeve shall contain a single letter or number, shall be elliptically shaped to securely grip the wire, and shall be keyed in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Each wire marker shall indicate the device or equipment, including specific terminal number to which the remote end of the wire is attached.

2.2.10 Surge Protective Device

Provide as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

2.4 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each switchboard, equipment enclosure, relay, switch, and device; as specified in this section or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.5 SOURCE QUALITY CONTROL

2.5.1 Equipment Test Schedule

The Government reserves the right to witness tests. Provide equipment test schedules for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.

3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.

4. Dated calibration labels shall be visible on all test equipment.

5. Calibrating standard shall be of higher accuracy than that of the instrument tested.

6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.5.2 Switchboard Design Tests

NEMA PB 2 and UL 891.

2.5.2.1 Design Tests

Furnish documentation showing the results of design tests on a product of the same series and rating as that provided by this specification.

a. Short-circuit current test

b. Enclosure tests

c. Dielectric test

2.5.3 Switchboard Production Tests

NEMA PB 2 and UL 891. Furnish reports which include results of production tests performed on the actual equipment for this project. These tests include:

a. 60-hertz dielectric tests

b. Mechanical operation tests

c. Electrical operation and control wiring tests

d. Ground fault sensing equipment test

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Equipment Grounding

Provide bare copper cable not smaller than No. 4/0 AWG not less than 24 inches below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 Switchboard

ANSI/NEMA PB 2.1.

3.3.2 Meters and Instrument Transformers

ANSI C12.1.

3.3.3 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3.4 Galvanizing Repair

Repair damage to galvanized coatings using ASTM A780/A780M, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

3.3.5 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

3.4.1 Interior Location

Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 4 inches thick. The top of the concrete slab shall be approximately 4 inches above finished floor. Edges above floor shall have 1/2 inch chamfer. The slab shall be of adequate size to project at least 8 inches beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 inches above slab surface.

3.5 FIELD QUALITY CONTROL

Contractor shall submit request for settings of breakers to the COR after approval of switchboard and at least 30 days in advance of their requirement.

3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.5.1.1 Switchboard Assemblies

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical, electrical, and mechanical condition.

3. Confirm correct application of manufacturer's recommended lubricants.

4. Verify appropriate anchorage, required area clearances, and correct alignment.

5. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

6. Verify that circuit breaker sizes and types correspond to approved shop drawings.

7. Verify that current transformer ratios correspond to approved shop drawings.

8. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

9. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

10. Clean switchboard.

11. Inspect insulators for evidence of physical damage or contaminated surfaces.

12. Exercise all active components.

13. Inspect all mechanical indicating devices for correct operation.

14. Verify that vents are clear.

15. Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

16. Inspect control power transformers.

b. Electrical Tests

1. Perform insulation-resistance tests on each bus section.

2. Perform overpotential tests.

3. Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.

4. Perform control wiring performance test.

5. Perform primary current injection tests on the entire current circuit in each section of assembly.

3.5.1.2 Circuit Breakers

Low Voltage Molded Case with Solid State Trips

a. Visual and Mechanical Inspection

1. Compare nameplate data with specifications and approved shop drawings.

2. Inspect circuit breaker for correct mounting.

3. Operate circuit breaker to ensure smooth operation.

4. Inspect case for cracks or other defects.

5. Inspect all bolted electrical connections for high resistance using low resistance ohmmeter, verifying tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method, or performing thermographic survey.

6. Inspect mechanism contacts and arc chutes in unsealed units.

b. Electrical Tests

1. Perform contact-resistance tests.

2. Perform insulation-resistance tests.

3. Perform Breaker adjustments for final settings in accordance with Government provided settings.

4. Perform long-time delay time-current characteristic tests

5. Determine short-time pickup and delay by primary current injection.

6. Determine ground-fault pickup and time delay by primary current injection.

7. Determine instantaneous pickup current by primary injection.

8. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and anti-pump function.

3.5.1.3 Current Transformers

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify correct connection.

4. Verify that adequate clearances exist between primary and secondary circuit.

5. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

6. Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

2. Perform insulation-resistance tests.

3. Perform polarity tests.

4. Perform ratio-verification tests.

3.5.1.4 Metering and Instrumentation

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify tightness of electrical connections.

b. Electrical Tests

1. Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

2. Calibrate watthour meters according to manufacturer's published data.

3. Verify all instrument multipliers.

4. Electrically confirm that current transformer and voltage transformer secondary circuits are intact.

3.5.1.5 Grounding System

a. Visual and Mechanical Inspection

1. Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

1. IEEE 81. Perform ground-impedance measurements utilizing the fall-of-potential method.On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.5.2 Follow-Up Verification

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device. Test shall require each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times for checks, settings, and tests.

-- End of Section --

SECTION 26 41 01.00 10

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C135.30	(1988) Standard for Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code
NFPA 780	(2011) Standard for the Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 96	(2005; Reprint Oct 2010) Standard for Lightning Protection Components
UL 96A	(2007; Reprint Oct 2010) Standard for Installation Requirements for Lightning Protection Systems
UL Electrical Construction	(2009) Electrical Construction Equipment Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-07 Certificates

Materials

1.3 QUALITY ASSURANCE

Submit detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide a system consisting of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and which is the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

2.2 MATERIALS

Submit proof of compliance with requirements of UL, where material or equipment is specified to comply. The label of or listing in UL Electrical Construction will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted.

2.2.1 General Requirements

Do not use any combination of materials that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture, unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist, which would cause corrosion of conductors, use conductors with protective coatings or oversize conductors. Where a mechanical hazard is involved, increase the conductor size to compensate for the hazard or protect the conductors by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.2.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.2.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 375 pounds/thousand feet, and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.2.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal.

Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. When perforated strips are provided, strips that are much wider than solid strips shall be. A strip width that is at least twice that of the diameter of the perforations shall be used. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 1-1/2 inch wide.

2.2.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of 2 feet above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 5 feet above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of 15 feet above vent opening. Air terminals more than 24 inch in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

2.2.4 Ground Rods

Rods made of copper-clad steel, stainless steel or solid copper shall conform to UL 467 and galvanized ferrous rods shall conform to IEEE C135.30. Ground rods shall be not less than 3/4 inch in diameter and 10 feet in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.2.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation.

2.2.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INTEGRAL SYSTEM

3.2.1 General Requirements

Provide a lightning protection system consisting of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on

the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.2.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inch for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 24 inch away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 24 inches away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

3.2.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inch. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 3 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.2.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 110 feet long, there shall be at least one additional down conductor for each additional 50 feet of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 250 feet in perimeter, there shall be at least one additional down conductor for each 100 feet of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. On structures exceeding 50 feet in height, there shall be at least one additional down conductor for each additional 60 feet of height or fraction thereof, except that this application shall not cause down conductors to be placed about the perimeter of the structure at intervals of less than 50 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 16 feet in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected by placing in pvc conduit.

3.2.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.2.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.2.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 3 feet, nor more than 8 feet, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value, the Contracting Officer shall be notified immediately. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 3 feet nor more than 8 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous.

3.2.2 Metal Roofs

Wood-Frame, Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 100 feet. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof. Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 3 square inch.

3.2.3 Metal Roofs With Metal Walls

Wood-Frame Building With Metal Roof and Metal Exterior Walls: The metal roof and the metal walls shall be bonded and made electrically continuous and considered as one unit. The air terminals shall be connected to and made electrically continuous with the metal roof as well as the roof and down conductors. All connections shall have electrical continuity and have a surface contact of at least 3 square inch.

3.2.4 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge.Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point of entrance by a ground connector. Connections to pipes shall be by means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding.All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground

connections to grounding electrons or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than 60 feet.

3.3 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. Metal bodies of conductance having an area of 400 square inch or greater or a volume of 1000 cubic inch or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inch. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

3.4 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI ANSLG C78.81	(2010) American National Standard for Electric Lamps--Double-Capped Fluorescent Lamps--Dimensional and Electrical Characteristics

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2007) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

CALIFORNIA ENERGY COMMISSION (CEC)

CEC Title 24	(1978; R 2005) California's Energy Efficiency Standards for Residential and Nonresidential Buildings

GREEN SEAL (GS)

GC-12	(1997) Occupancy Sensors

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000; Errata 2004; Errata 2005; Errata 2006) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012) National Electrical Safety Code
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C78.901	(2005) American National Standard for Electric Lamps - Single Base Fluorescent Lamps--Dimensional and Electrical Characteristics
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C82.11	(2011) American National Standard for High-Frequency Fluorescent Lamp Ballasts--Supplements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA LL 1	(1997; R 2002) Procedures for Linear Fluorescent Lamp Sample Preparation and the TCLP Extraction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2012) Life Safety Code
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1598	(2008; Reprint Jan 2010) Luminaires
UL 773	(1995; Reprint Mar 2002) Standard for Plug-In, Locking Type Photocontrols for Use with Area Lighting

UL 773A	(2006; Reprint Mar 2011) Standard for Nonindustrial Photoelectric Switches for Lighting Control
UL 924	(2006; Reprint Feb 2011) Standard for Emergency Lighting and Power Equipment
UL 935	(2001; Reprint Jun 2010) Standard for Fluorescent-Lamp Ballasts

1.2 RELATED REQUIREMENTS

Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

c. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SYSTEM DESCRIPTION

1.4.1 Lighting Control System

Provide lighting control system as indicated. Lighting control equipment shall include, if indicated: control modules, power packs, dimming ballasts, occupancy sensors, and light level sensors.

1.5 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IESNA HB-9, as applicable, for the lighting system specified.

SD-03 Product Data

Fluorescent lighting fixtures;

Fluorescent electronic ballasts;

Fluorescent lamps;

LED Fixtures;

Incandescent lighting fixtures;

Incandescent lamps;

Lighting contactor;

Photocell switch;

Exit signs;

Emergency lighting equipment;

Occupancy sensors;

SD-06 Test Reports

Operating test

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5

Submit operation and maintenance data in accordance with DIVISION 01 GENERAL REQUIREMENTS and as specified herein, showing all light fixtures, control modules, control zones, occupancy sensors, power packs, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

1.6 QUALITY ASSURANCE

1.6.1 Fluorescent Electronic Ballasts

Submit ballast catalog data as required in the paragraph entitled "Fluorescent Lamp Electronic Ballasts" contained herein. As an option, submit the fluorescent fixture manufacturer's electronic ballast specification information in lieu of the actual ballast manufacturer's catalog data. This information shall include published specifications and sketches, which covers the information required by the paragraph entitled "Fluorescent Lamp Electronic Ballasts" herein. This information may be supplemented by catalog data if required, and shall contain a list of vendors with vendor part numbers.

1.6.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall

include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer

1.6.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.3.3 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 Electronic Ballast Warranty

Furnish the electronic ballast manufacturer's warranty. The warranty period shall not be less than 5 years from the date of manufacture of the electronic ballast. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed 12 months, thereby permitting 4 years of the ballast 5 year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

1.8 OPERATIONAL SERVICE

Indicate procedures for compliance with regulations governing disposal of mercury.

1.9 SUSTAINABLE DESIGN REQUIREMENTS

1.9.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES

UL 1598. Fluorescent fixtures shall have electronic ballasts.

2.1.1 Fluorescent Lamp Electronic Ballasts

The electronic ballast shall as a minimum meet the following characteristics:

a. Ballast shall comply with UL 935, NEMA ANSLG C82.11, NFPA 70, and CEC Title 24 unless specified otherwise. Ballast shall be 100 percent electronic high frequency type with no magnetic core and coil components. Ballast shall provide transient immunity as recommended by IEEE C62.41.1 and IEEE C62.41.2. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.

b. Ballast shall operate at a frequency of 20,000 Hertz (minimum). Ballast shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems. Provide ballasts operating at or above 40,000 Hertz where available.

c. Ballast shall have light regulation of plus or minus 10 percent lumen output with a plus or minus 10 percent input voltage regulation. Ballast shall have 10 percent flicker (maximum) using any compatible lamp.

d. Ballast factor shall be between 0.85 (minimum) and 1.00 (maximum). Current crest factor shall be 1.7 (maximum).

e. Ballast shall be UL listed Class P with a sound rating of "A."

f. Ballast shall have circuit diagrams and lamp connections displayed on the ballast.

g. Ballasts shall be instant start unless otherwise indicated. Instant start ballasts shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed.

h. Ballasts for compact fluorescent fixtures shall be programmed start.

i. Ballasts for T-5 and smaller lamps shall have end-of-life protection circuits as required by ANSI ANSLG C78.81 and ANSI C78.901 as applicable.

j. Ballast shall be capable of starting and maintaining operation at a minimum of 0 degrees F unless otherwise indicated.

k. Electronic ballast shall have a full replacement warranty of 5 years from date of manufacture as specified in paragraph entitled "Electronic Ballast Warranty" herein.

2.1.1.1 T-8 Lamp Ballast

a. Total harmonic distortion (THD): Shall be 20 percent (maximum).

b. Input wattage.

1. 28 watts (maximum) when operating one F28T8 lamp

2.1.2 Fluorescent Lamps

a. T-8 rapid start low mercury lamps shall be rated 28 watts (maximum), 2800 initial lumens (minimum), CRI of 80 (minimum), color temperature of 4100 K, and an average rated life of 20,000 hours. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.

b. Compact fluorescent lamps shall be: CRI 80, minimum, 4100K, 10,000 hours average rated life, and as follows:

1. T-4, triple twin tube, rated 18 watts, 1200 initial lumens (minimum), and 26 watts, 1800 initial lumens (minimum), 32 watts, 2400 initial lumens (minimum).

Average rated life is based on 3 hours operating per start.

2.1.3 Compact Fluorescent Fixtures

Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall use lamps as indicated, with a minimum CRI of 80.

2.1.4 Open-Tube Fluorescent Fixtures

Provide with self-locking sockets, or lamp retainers (two per lamp).

2.2 INCANDESCENT LIGHTING FIXTURES

UL 1598.

2.2.1 Incandescent Lamps

Provide the number, type, and wattage indicated.

2.3 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

2.4 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb

installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

2.5 SWITCHES

2.5.1 Toggle Switches

Provide toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.6 LIGHTING CONTACTOR

NEMA ICS 2, electrically held contactor. Rate contactor as indicated. Provide in NEMA 1 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts. Provide contactor with hand-off-automatic selector switch.

2.7 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 120 volts ac, 60 Hz with single-throw contacts. Switch shall turn on at or below 3 footcandles and off at 2 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide switch:

a. In a cast weatherproof aluminum housing with adjustable window slide, rated 1800 VA, minimum.

2.8 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type. Exit signs shall use no more than 5 watts.

2.8.1 Self-Powered LED Type Exit Signs (Battery Backup)

Provide with automatic power failure device, test switch, pilot light, integral self-testing module and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit sign shall have emergency run time of 1 1/2 hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).

2.9 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

2.9.1 Emergency Lighting Unit

Provide as indicated. Emergency lighting units shall be rated for 12 volts, except units having no remote-mounted lamps and having no more than two

unit-mounted lamps may be rated 6 volts. Equip units with brown-out sensitive circuit to activate battery when ac input falls to 75 percent of normal voltage. Provide integral self-testing module.

2.9.2 Fluorescent Emergency System

Each system shall consist of an automatic power failure device, test switch operable from outside of the fixture, pilot light visible from outside the fixture, and fully automatic solid-state charger in a self-contained power pack. Provide self-testing module integral to the fixture. Charger shall be either trickle, float, constant current or constant potential type, or a combination of these. Battery shall be sealed electrolyte type with capacity as required to supply power to 2 lamps for 90 minutes at the minimum lumens shown on fixture schedule. Battery shall operate unattended and require no maintenance, including no additional water, for a period of not less than 5 years. Emergency ballasts provided with fixtures containing solid-state ballasts shall be fully compatible with the solid-state ballasts.

2.10 SELF-TESTING MODULE

Self-testing module for exit signs and emergency lighting equipment shall perform the following functions:

a. Continuous monitoring of charger operation and battery voltage with visual indication of normal operation and of malfunction.

b. Monthly discharge cycling of battery with monitoring of transfer circuit function, battery capacity and emergency lamp operation with visual indication of malfunction. The battery capacity test may be conducted by using a synthetic load.

c. Manual test switch to simulate a discharge test cycle.

d. Module shall have low voltage battery disconnect (LVD) and brown-out protection circuit.

2.11 OCCUPANCY SENSORS

UL listed. Comply with GC-12. Occupancy sensors and power packs shall be designed to operate on the voltage indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator.Sensor shall have adjustable sensitivity and adjustable delayed-off time range of 5 minutes to 15 minutes. Wall mounted sensors shall match the color of adjacent wall plates as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated.

a. Ultrasonic sensor shall be crystal controlled and shall not cause detection interference between adjacent sensors.

b. Infrared sensors shall have a daylight filter. Sensor shall have a fresnel lens that is applicable to space to be controlled.

c. Ultrasonic/Infrared Combination Sensor

d. Microwave and audiophonic sensors.

Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection. Lights shall remain on if either the ultrasonic or infrared sensor detects movement. Infrared sensor shall have lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Ultrasonic sensor frequency shall be crystal controlled.

2.12 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

2.12.1 Wires

ASTM A641/A641M, galvanized regular coating, soft temper, 0.1055 inches in diameter (12 gage).

2.12.2 Straps

Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.12.3 Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.13 EQUIPMENT IDENTIFICATION

2.13.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.13.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. All luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only_____":

a. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

c. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

d. ANSI ballast type (M98, M57, etc.) for HID luminaires.

e. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

All markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.14 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer.

3.1.2 Lighting Fixtures

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four wires or straps or rods per fixture and located near each corner of each fixture. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires or straps or rods per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture. Provide wires or straps or rods for lighting fixture support in this section. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

3.1.3 Suspended Fixtures

Suspended fixtures shall be provided with 45 degree swivel hangers so that they hang plumb and shall be located with no obstructions within the 45

degree range in all directions. The stem, canopy and fixture shall be capable of 45 degree swing. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degree separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.4 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.

3.1.5 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations. Set adjustable window slide for 3 minimum footcandles photocell turn-on.

3.1.6 Occupancy Sensor

Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage shall provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid nuisance activation and deactivation due to sudden temperature or airflow changes and usage. Set sensor "on" duration to 10 minutes.

3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.

3.3.1 Occupancy Sensor

Test sensors for proper operation. Observe for light control over entire area being covered.

-- End of Section --

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS-4	(2006) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C136.21	(2004) Roadway Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 108	(2006) Standard Specification for Aluminum-Alloy Permanent Mold Castings

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000; Errata 2004; Errata 2005) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; Errata 2007) National Electrical Safety Code
IEEE Std 100	(2000) The Authoritave Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C136.13	(2004) Roadway Lighting Equipment, Metal Brackets for Wood Poles
NEMA C136.3	(2005) Roadway and Area Lighting Equipment Luminaire Attachments
NEMA C78.42	(2004) Standard for High-Pressure Sodium Lamps
NEMA C78.43	(2007) Standard for Electric Lamps - Single-Ended Metal-Halide Lamps
NEMA C82.4	(2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
NEMA ICS 2	(2000; Errata 2002; R 2005; Errata 2006) Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment
NEMA ICS 6	(1993; R 2006) Standard for Industrial Controls and Systems Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1029	(1994; Rev thru Feb 2006) Standard for Safety High-Intensity-Discharge Lamp Ballasts
UL 1598	(2004; Rev thru May 2006) Luminaires
UL 773	(1995; Rev thru Mar 2002) Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2006) Nonindustrial Photoelectric Switches for Lighting Control

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Energy Efficiency

Luminaires;

Lamps;

Ballasts;

Lighting contactor;

Time switch;

Photocell switch;

Aluminum poles;

SD-06 Test Reports

Operating test;

Submit operating test results.

SD-10 Operation and Maintenance Data

Operational Service

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project.

1.4 QUALITY ASSURANCE

1.4.1 Not used.

1.4.2 Not used.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer Technical Representative.

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Aluminum Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.6.2 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

1.7 WARRANTY

Comply with warranty provisions of Section 01 78 00, "CLOSEOUT SUBMITTALS." The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render

satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 OPERATIONAL SERVICE

Indicate procedures for compliance with regulations governing disposal of mercury.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in Section 26 51 00 INTERIOR LIGHTING.

2.2 LUMINAIRES

UL 1598. Provide luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.2.1 Lamps

2.2.1.1 High-Pressure Sodium (HPS) Lamps

NEMA C78.42. Wattage as indicated. HPS lamps shall have average rated life of 16,000 hours (minimum) for 35 watt lamps and 24,000 hours (minimum) for all higher wattage lamps. 150 watt lamps, if required, shall be 55 volt lamps. Lamps shall have Luminaire Efficiency Ratings (LER) as follows:

a. Upward efficiency of 0%

    1. 150-399 watts: minimum 58 LER for closed fixture; minimum 68 for open fixture

    2. 400-999 watts: minimum 63 LER for closed fixture; minimum 84 for open fixture

b. Upward efficiency of 1%-10%

    1. 150-399 watts: minimum 64 LER for closed fixture; minimum 63 for open fixture

    2. 400-999 watts: minimum 82 LER for closed fixture; minimum 89 for open fixture

    3. 1000+ watts: minimum 109 LER for open fixture

c. Upward efficiency of 11% to 20%

1. 150-399 watts: minimum 78 LER for open fixture

2. 400-999 watts: minimum 94 for open fixture

d. Upward efficiency greater than 20%

1. 150-399 watts: minimum 75 LER for closed fixture; minimum 77 for open fixture

2.2.1.2 Metal-Halide Lamps

Provide luminaires with tempered glass lens.

a. Single-ended, wattage as indicated, conforming to NEMA C78.43

Lamps shall have Luminaire Efficiency Ratings (LER) as follows:

a. Upward efficiency of 0%

1. 150-399 watts: minimum 41 LER for closed fixture

2. 400-999 watts: minimum 53 LER for closed fixture; minimum 59 for open fixture

3. 1000+ watts: minimum 77 LER for closed fixture

b. Upward efficiency of 1%-10%

1. 150-399 watts: minimum 56 LER for closed fixture

2. 400-999 watts: minimum 62 LER for closed fixture; minimum 64 for open fixture

3. 1000+ watts: minimum 88 LER for open fixture

c. Upward efficiency greater than 20%

1. 150-399 watts: minimum 62 LER for closed fixture; minimum 77 for open fixture

2. 400-999 watts: minimum 65 LER for closed fixture

2.2.2 Ballasts for High-Intensity-Discharge (HID) Luminaires

UL 1029 and NEMA C82.4, and shall be constant wattage autotransformer (CWA) or regulator, high power-factor type (minimum 90%). Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts shall be:

a. Designed to operate on voltage system to which they are connected.

b. Constructed so that open circuit operation will not reduce the average life.

HID ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 degrees C.

2.3 LIGHTING CONTACTOR

NEMA ICS 2, mechanically held contactor. Rate contactor as indicated. Provide in NEMA 4 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts and coil clearing contacts for mechanically held contactor and shall require no arcing contacts. Provide contactor with hand-off-automatic selector switch.

2.4 TIME SWITCH

Astronomic dial type or electronic type, arranged to turn "ON" at sunset, and turn "OFF" at predetermined time between 8:30 p.m. and 2:30 a.m. or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide switch rated 208 volts, having automatically wound spring mechanism or capacitor, to maintain accurate time for a minimum of 7 hours following power failure. Provide time switch with a manual on-off bypass switch. Housing for the time switch shall be surface mounted, NEMA 1 enclosure conforming to NEMA ICS 6.

2.5 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 208 volts ac, 60 Hz with single-throw contacts designed to fail to the ON position. Switch shall turn on at or below 3 footcandles and off at 4 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition. Provide switch:

a. Integral to the luminaire, rated 1000 VA, minimum.

2.6 POLES

Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS-4 while supporting luminaires and all other appurtenances indicated.The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws. Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole. Scratched, stained, chipped, or dented poles shall not be installed.

2.6.1 Aluminum Poles

Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a round or tapered cover. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B 108 and shall be machined to receive the lower end of shaft.Joint between shaft and base shall be

welded. Base cover shall be cast 356-T6 aluminum alloy in accordance with ASTM B 108. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel. Manufacturer's provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

2.7 BRACKETS AND SUPPORTS

NEMA C136.3, NEMA C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

2.8 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A 153/A 153M. Concrete shall be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.9 EQUIPMENT IDENTIFICATION

2.9.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. Luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only_____":

a. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

c. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

d. ANSI ballast type (M98, M57, etc.) for HID luminaires.

e. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.10 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Aluminum Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3.1.2 Pole Setting

Depth shall be as indicated. Poles in straight runs shall be in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6 inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

3.1.3 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.1.4 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.1.5 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

SECTION 27 05 14.00 10

CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 SYSTEM DESCRIPTION

Provide a cable TV premises distribution system consisting of coaxial cables, amplifiers, and connecting hardware for the transport of television signals throughout the building to user locations as indicated.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Test Plan;
Qualifications;

SD-06 Test Reports

Testing

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

1.4 QUALIFICATIONS

Submit proof of the qualifications of the Contractor, Installers, and Manufacturers that will perform the work, and provide the specified products.

1.4.1 Minimum Contractor Qualifications

Work under this section shall be performed, and equipment shall be furnished and installed, by a qualified Contractor as defined herein. The Contractor shall have a minimum of two years of experience in the installation and testing of coaxial cable-based TV distribution systems and equipment. Installers assigned to the installation of this system or its components shall have a minimum of two years of experience in the installation of the specified coaxial cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract shall be products of manufacturers that have a minimum of two years of experience in producing the types of systems and equipment specified.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.6 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that are the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70. Cables shall be labeled on both ends with circuit number, room number, or other appropriate marking allowing for correct identification of the cable and its destination. Each faceplate shall be labeled with its function and a unique number to identify the cable run.

2.1.1 Coaxial Cable

Coaxial cable shall be RG-6/U, quad shield. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals identifying cable type. Cable shall be rated CMP in accordance with NFPA 70. Interconnecting cables shall be cable assemblies consisting of RG-6/U coaxial cable with male connectors at each end, provided in lengths determined by equipment locations as shown.

2.1.2 Outlets

Cable television outlets, including wall outlet plates, shall be equipped with a female connector to accept the connecting coaxial cable from the user's television set. Faceplates provided shall be ivory resistant plastic.

2.1.3 Outlet Boxes

Electrical boxes for cable television outlets shall be 4-11/16 inch square by 2-1/4 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Conduits shall be minimum 1 inch.

PART 3 EXECUTION

3.1 INSTALLATION

Install system components and appurtenances in accordance with NFPA 70, manufacturer's instructions and as shown. Provide necessary interconnections, services, and adjustments required for a complete cable television distribution system, ready to connect to external television signal sources. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07 84 00 FIRESTOPPING. Install conduits, outlets, raceways, and wiring in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Cables and outlets shall be individually labeled and marked. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Cable Installation

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Cable not in a wireway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated unless shown otherwise. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. Provide 20 foot long service loop in telecommunication rooms.

3.1.2 Cables

Cables shall have a minimum of 6 inches of slack cable loosely coiled into the cable television outlet boxes. Minimum manufacturer's bend radius shall not be exceeded.

3.1.3 Pull Cords

Pull cords shall be installed in conduits serving the cable television premises distribution system which do not initially have cable installed.

3.2 TERMINATIONS

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. Coaxial cables shall be terminated with appropriate connectors as required. Cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.3 GROUNDING

The cable television distribution system ground shall be installed in the cable television entrance facility and in any auxiliary closet identified in

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM or otherwise indicated. Equipment racks shall be connected to the electrical safety ground.

3.4 TESTING

Submit test reports in booklet form with witness signatures verifying execution of tests. The cable system testing documentation shall include the physical routing and a test report for each cable (end-to-end) from the installed outlet to the main termination point. Test reports shall be submitted within 14 days after completion of testing. Materials and documentation to be furnished under this specification are subject to inspections and tests.

a. Submit a Test Plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 30 days prior to the proposed test date. The plan shall be approved before testing begins. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

b. Components shall be terminated prior to testing.

c. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the cable television premises distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

d. After installation of the cable and before connecting system components, each cable section shall be end-to-end tested using a time domain reflectometer (TDR) to determine shorts, opens, kinks, and other impedance discontinuities and their locations. Cable sections showing adverse impedance discontinuities (greater than 6 dB loss) shall be replaced at the Contractor's expense.

e. There shall be no cable splices between system components unless approved by the Government.

3.5 OPERATION AND MAINTENANCE MANUALS

SD-10 Submit commercial, off-the-shelf manuals for operation, installation, configuration, and maintenance of products provided as a part of the cable television premises distribution system. Specification sheets for cable, connectors, and other equipment shall be provided as specified in the Submittals paragraph.

-- End of Section --

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-90-661	(2008) Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables for Use in General Purpose and LAN Communications Wiring Systems Technical Requirements

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA/BICSI 568	(2006) Standard for Installing Building Telecommunications Cabling

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66	(2001; Errata 2003) Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA J-STD-607	(2002a) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
TIA-1152	(2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

TIA-568-C.0	(2009; Add 1 2010) Generic Telecommunications Cabling for Customer Premises
TIA-568-C.1	(2009) Commercial Building Telecommunications Cabling Standard
TIA-568-C.2	(2009; Errata 2010) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568-C.3	(2008; Corrections 2008) Optical Fiber Cabling Components Standard
TIA-569	(2004b; Add 1 2009) Commercial Building Standard for Telecommunications Pathways and Spaces
TIA/EIA-606	(2002a; Errata 2007; R 2007; Adm 1 2008) Administration Standard for the Telecommunications Infrastructure

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68	Connection of Terminal Equipment to the Telephone Network (47 CFR 68)

UNDERWRITERS LABORATORIES (UL)

UL 1286	(2008; Reprint Jan 2011) Office Furnishings
UL 1863	(2004; Reprint Aug 2008) Communication Circuit Accessories
UL 444	(2008; Reprint Apr 2010) Communications Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(1995; Reprint Nov 2008) Standard for Marking and Labeling Systems

1.2 RELATED REQUIREMENTS

Technical Criteria for the Installation Information Infrastructure Architecture (I3A) applies to this section.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA/EIA-606 and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

1.3.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.3.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.7 Open Cable

Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed horizontal cabling, horizontal pathways, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a

building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.5 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Telecommunications cabling (horizontal);

Patch panels;

Telecommunications outlet/connector assemblies;

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing;

SD-07 Certificates

Telecommunications Contractor Qualifications;

Test plan;

1.6 QUALITY ASSURANCE

1.6.1 Not used

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation,

and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.2.2 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, 30 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size.The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package 5.

PART 2 PRODUCTS

2.1 COMPONENTS

Comments shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569. Provide system furniture pathways in accordance with UL 1286.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and NFPA 70. Provide a labeling system for cabling as required by TIA/EIA-606 and UL 969. Ship cable on reels or in boxes bearing manufacture date for unshielded twisted pair (UTP) in accordance with ICEA S-90-661 for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.3.1 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568-C.1.

2.3.1.1 Horizontal Copper

Provide horizontal copper cable, UTP, 100 ohm in accordance with TIA-568-C.2, UL 444, ANSI/NEMA WC 66, ICEA S-90-661. Provide four each individually twisted pair, minimum size 24 AWG conductors, Category 6, with a thermoplastic jacket. Provide a blue jacket for voice and a yellow jacket for data. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with ICEA S-90-661. Provide plenum (CMP) communications rated cabling in accordance with NFPA 70. Cables installed in conduit within and under slabs shall be UL listed and labeled for wet locations in accordance with NFPA 70.

2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility and telecommunication equipment room to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with TIA/EIA-606.

2.4.1 Backboards

Provide void-free, interior grade A-C plywood 3/4 inch thick 4 by 8 feet. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible. Backboards shall be provided on a minimum of two adjacent walls in the telecommunication spaces.

2.4.2 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 6 systems. Provide blocks for the number of horizontal cables terminated on the block plus 25 percent spare.

2.4.3 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on equipment racks cabinets and telecommunications backboards.

2.4.4 Patch Panels

Provide ports for the number of horizontal cables terminated on the panel plus 25 percent spare. Provide pre-connectorized copper patch cords for patch panels, one for each connected port. Provide patch cords, as complete assemblies, with matching connectors as specified, 7 feet in length with blue jacket. Patch cords shall meet minimum performance requirements specified in TIA-568-C.1, TIA-568-C.2 for cables, cable length and hardware specified.

2.4.4.1 Modular to 110 Block Patch Panel

Provide in accordance with TIA-568-C.1 and TIA-568-C.2. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Panel shall be constructed of 0.09 inches minimum aluminum and shall be rack mounted and compatible with an existing equipment cabinet. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568B(verify and match existing wiring method). Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68, TIA-568-C.1, and TIA-568-C.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568-C.2 Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired as indicated in subparagraph, Modular to 110 Block Patch Panel. UTP outlet/connectors shall comply with TIA-568-C.2 for 200 mating cycles.Provide pre-connectorized patch cords, one for each port, 12 feet in length with blue jacket.

2.5.2 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568-C.1, TIA-568-C.2; flush design constructed of high impact thermoplastic material ivory in color to match color. Provide labeling in accordance with the paragraph LABELING in this section.

2.6 GROUNDING AND BONDING PRODUCTS

Provide in accordance with UL 467, TIA J-STD-607, and NFPA 70. Components shall be identified as required by TIA/EIA-606. Provide ground rods, bonding conductors, and grounding busbars.

2.7 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.8 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when

applicable, the position. Nameplates shall be melamine plastic, 0.125 inches thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inches high normal block style.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with NECA/BICSI 568, TIA-568-C.1, TIA-568-C.2, TIA-569, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.

3.1.1 Cabling

Install UTP, telecommunications cabling system as detailed in TIA-568-C.1, TIA-568-C.2. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays. Install in accordance with TIA-568-C.1, TIA-568-C.2.Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

Plenum cable shall be used where open cables are routed through plenum areas. Plenum cables shall comply with flammability plenum requirements of NFPA 70.

3.1.1.2 Horizontal Cabling

Install horizontal cabling as indicated on drawings Do not untwist Category 6 UTP cables more than one half inch from the point of termination to

maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, 10 feet in the telecommunications room, and 12 inches in the work area outlet.

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70.

3.1.3 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only CMP type cable shall be installed in a plenum.

3.1.4 Work Area Outlets

3.1.4.1 Terminations

Terminate UTP cable in accordance with TIA-568-C.1, TIA-568-C.2 and wiring configuration as specified.

3.1.4.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.4.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.4.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.5 Telecommunications Space Termination

Install termination hardware required for Category 6 system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

3.1.5.1 Connector Blocks

Connector blocks shall be wall mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with TIA-569.

3.1.5.2 Patch Panels

Patch panels shall be mounted in equipment cabinets provided by FLETC. Provide sufficient ports to accommodate the installed cable plant plus 25 percent spares.

a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel with cable ties to prevent movement of the cable.

3.1.5.3 Equipment Support Frames

Install in accordance with TIA-569:

a. Cabinets, freestanding modular type. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets.

3.1.6 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

3.1.7 Grounding and Bonding

Provide in accordance with TIA J-STD-607, NFPA 70.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA/EIA-606. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process or laser printer.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA/EIA-606.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA/EIA-606.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

If backboards are required to be painted, then the manufactured fire retardant backboard must be painted with fire retardant paint, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be unpainted.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1, TIA-568-C.2. Test equipment shall conform to TIA-1152.

3.5.1.1 Inspection

Visually inspect UTP jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross-connected.

3.5.1.3 Performance Tests

Perform testing for each outlet as follows:

a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

3.5.1.4 Final Verification Tests

Perform verification tests for UTP systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

a. Voice Tests.These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --

SECTION 28 31 64.00 10

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1221	(2010) Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code
NFPA 72	(2010; TIA 10-4) National Fire Alarm and Signaling Code
NFPA 90A	(2009; Errata 09-1) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2006; Reprint Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL 268	(2009) Smoke Detectors for Fire Alarm Systems

UL 268A	(2008; Reprint Sep 2009) Smoke Detectors for Duct Application
UL 38	(2008; Reprint Dec 2008) Manual Signaling Boxes for Fire Alarm Systems
UL 464	(2009; Reprint Jan 2011) Standard for Audible Signal Appliances
UL 521	(1999; Reprint May 2010) Heat Detectors for Fire Protective Signaling Systems
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 864	(2003; Reprint Jan 20110) Standard for Control Units and Accessories for Fire Alarm Systems

1.2 SYSTEM DESCRIPTION

The fire detection and alarm system and the central reporting system shall be a complete, supervised fire alarm reporting system configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. Furnish equipment compatible and UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards. Locks shall be keyed alike. Provide four keys for the system. Furnish tags with stamped identification number for keys and locks.

1.2.1 Operation

Activate the system into the alarm mode by actuation of any alarm initiating device. The system will remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm and supervisory initiating devices shall be individually addressable. Alarm initiating devices shall be connected to initiating device circuits (IDC), Class B, to signal line circuits (SLC), Classe B, in accordance with NFPA 72. Connect alarm notification appliances to notification appliance circuits (NAC), Class A in accordance with NFPA 72. Provide a looped conduit system so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

a. Sufficient memory to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors.

c. Capability of each addressable device being individually disabled or enabled from the panel.

d. Size each SLC to provide 40 percent addressable expansion without hardware modifications to the panel.

1.2.2 Operational Features

The system shall have the following operating features:

a. Monitor electrical supervision of IDC, SLC, and NAC circuits.

b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. Submit Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.

f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD displays on the control panel nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.

g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.

h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.

i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.

k. The fire alarm control panel shall monitor and control the fire sprinkler system, fire pump controllers, or other fire protection extinguishing system.

l. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

n. Fire alarm shall be arranged as indicated on the contract drawings.

1.2.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the functions shown on the design drawings.

1.2.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.2.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.2.6 Interface With Existing Fire Alarm Equipment

The entire existing fire alarm system including all panels shall be demolished after the new system has been accepted.

1.2.7 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc. Components shall also be

compatible with proprietary supervising station receiving equipment (Bosch D6600).

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Storage Batteries
Low Battery Voltage
Special Tools and Spare Parts
Technical Data and Computer Software
Training
Testing

SD-06 Test Reports

Testing

SD-07 Certificates

Equipment
Qualifications

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions;

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Submit proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

1.4.1.1 Engineer and Technician

a. Registered Professional Engineer in the State of Georgia with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.4.1.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.4.1.3 Fire Protection Engineer

The fire protection engineer shall be registered in the State of Georgia.

1.4.2 Detail Drawings

Submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical audible appliances. Check the layout based on the actual audible devices to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detail drawings and detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

a. Identification of programmable portions of system equipment and capabilities.

b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

c. Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.

d. Description of Fire Alarm Control Panel equipment operation.

e. Description of auxiliary and remote equipment operations.

f. Library of application software.

g. Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

1.7 SPECIAL TOOLS AND SPARE PARTS

Submit spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service. Furnish software, connecting cables, proprietary equipment and two spare fuses of each type and size required, necessary for the maintenance, testing, and reprogramming of the equipment. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Mount spare fuses in the fire alarm panel.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

2.2 NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

2.3 FIRE ALARM CONTROL PANEL

The Fire Alarm Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches.

a. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices

(meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system.

b. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other devices. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

c. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units.Cabinets shall be painted red.

2.3.1 Circuit Connections

Connect circuit conductors entering or leaving the panel to screw-type terminals with each conductor and terminal marked for identification.

2.3.2 System Expansion and Modification Capabilities

Provide, as part of this contract, any equipment and software needed by qualified technicians to implement future changes to the fire alarm system.

2.3.3 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Class B notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.3.4 Addressable Initiating Device Circuits Module

Configure the initiating device being monitored as a Class B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time

the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.4 STORAGE BATTERIES

Submit substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included. Provide storage batteries which are 24 Vdc sealed, lead-calcium type requiring no additional water with ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 24 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 5 minutes. Locate batteries at the bottom of the panel. Provide batteries with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Paint the cabinets to match the fire alarm control panel.

2.5 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Locate charger in control panel cabinet or in a separate battery cabinet.

2.6 FIRE ALARM MANUAL STATIONS

Fire alarm manual stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on surface mounted outlet boxes. Manual stations shall be mounted at 48 inches. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations.

2.7 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually

addressable, except where indicated. Installed devices shall conform to NFPA 70 hazard classification of the area where devices are to be installed.

2.7.1 Smoke Detectors

Design smoke detectors for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location. Smoke detector shall be provided above panel in Fire Pump Room.

2.7.1.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.7.1.2 Duct Smoke Detectors

Duct smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.8 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be

painted red. Recessed audible appliances shall be installed with a grill that is painted red.

2.8.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.8.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 15 candela, but shall be sized as shown on drawings. Strobe shall be surface mounted.

2.8.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.9 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.9.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.9.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 16 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

2.10 TRANSMITTERS

2.10.1 Digital Alarm Communicator Transmitters (DACT)

Transmitters shall be compatible with proprietary supervising station receiving equipment (Bosch D6600). Each transmitter shall be the

manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is Bosch D6600 through windows based management Mastermind and the transceiver shall be fully compatible with this equipment. At the Contractors option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel. The DACT shall receive an alarm, supervisory, or trouble signal from the control unit and automatically capture two telephone lines(s) and dial a preset number for a remote central station. When contact is made with the central station, signals shall be transmitted in contact ID protocol. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station.

2.10.1.1 Transmitter Power Supply

Each transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery in addition to manufacturers operation power requirements.

a. Operation: Each transmitter shall operate from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall also be automatic.

b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 24 hours and be capable of transmitting alarms during that period.

2.10.1.2 Digital Alarm Communicator Transmitter Housing

Transmitter housing shall be NEWMAN Type 1. The housing shall contain a lock that is keyed identical to the fire alarm system for the building. Digital alarm communicator transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.11 FIRE ALARM ANNUNCIATOR

2.11.1 FIRE ALARM ANNUNCIATOR PANEL

Provide an annunciator that includes an LCD display. The display shall indicate the device in trouble/alarm or any supervisory device. Display the device name, address, and actual building location. A building floor plan shall be provided mounted (behind plexiglass or similar protective material) at the annunciator location. The floor plan shall indicate all rooms by name and number including the locations of stairs and elevators.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

Install all work as shown, in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.2.1 Power Supply for the System

Provide a single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system panel. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.2.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.2.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. Manually operable controls shall be between 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.2.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be

provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location.

3.2.5 Notification Appliances

Notification appliances shall be mounted 80 inches above the finished floor or 6 inches below the ceiling, whichever is lower.

3.2.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.2.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in Section 21 13 13.00 10 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, as indicated on the drawings and as specified herein.

3.2.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall he mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in Section 21 13 13.00 10 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, as indicated on the drawings and as specified herein.

3.3 OVERVOLTAGE AND SURGE PROTECTION

3.3.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.3.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.3.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.4 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.5 TRAINING

Submit lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. Conduct the course in the building where the system is installed or as designated by the Contracting Officer.

a. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system. Provide training course for the maintenance staff.The training period for system expansions and modifications shall consist of at least 1/2 training day (4 hours) and shall start after the system is functionally completed but prior to final acceptance tests.

3.6 TESTING

Notify the Contracting Officer and the Fire Protection Engineer at least 10 days before the preliminary and acceptance tests are to be conducted. Perform the tests in accordance with the approved test procedures in the

presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. Furnish instruments and personnel required for the tests. The Fire Protection Engineer needs to be present and sign off on all testing conducted for the fire protection systems.

a. Submit detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

b. Submit test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. Include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

3.6.1 Preliminary Tests

Upon completion of the installation, subject the system to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. Conduct the megger test prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing complete and submit the NFPA 72, Certificate of Completion and Testing Form.

3.6.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Conduct testing in accordance with NFPA 72. The recommended tests in NFPA 72 are considered mandatory and shall verify that previous deficiencies have been corrected. The Fire alarm Technician supervising the installation of the fire alarm system shall attend the testing of the system. The test shall include all requirements of NFPA 72 and the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of each alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault each circuit.

k. Short circuit faults each circuit.

l. Stray voltage test.

m. Loop resistance test.

-- End of Section --

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 MEASUREMENT PROCEDURES

1.2 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Material character is indicated by the boring logs.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA P5	(2009) Standard for Waterborne Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM A139/A139M	(2004; R 2010) Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and over)

ASTM A252	(2010) Standard Specification for Welded and Seamless Steel Pipe Piles
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM D1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.4 DEFINITIONS

1.4.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SC, CL, ML, CL-ML. Satisfactory materials for grading comprise stones less than 1.5 inches in any dimension.

1.4.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and

material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.4.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136, ASTM D422, and ASTM D1140.

1.4.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.4.5 Topsoil

Material suitable for topsoils obtained from offsite areas and excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.4.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.4.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.4.8 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.4.9 Select Granular Material

1.4.9.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, or SP by ASTM D2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index must not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D1140.

1.4.10 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 1.5 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 1.5 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.4.11 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 15 when tested in accordance with ASTM D4318.

1.5 SYSTEM DESCRIPTION

Subsurface soil boring logs are appended to the SPECIAL CONTRACT REQUIREMENTS. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.5.1.2 Rock Excavation

Submit notification of encountering rock in the project. Include rock excavation with blasting, excavating, grading, disposing of material classified as rock, and the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove

without systematic drilling and blasting; and hard materials (see Definitions). Include the removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic yard in volume that may be encountered in the work in this classification.If at any time during excavation, the Contractor encounters material that may be classified as rock excavation, uncover such material and notify the Contracting Officer. Do not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.5.2 Blasting

Blasting will not be permitted.

1.5.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.6 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Testing
Borrow Site Testing

SD-07 Certificates

Testing

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1.Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Within 24 hours of conclusion of physical tests, submit 3 copies of test results, including calibration curves and results of calibration tests. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

Provide Bedding material, Filter fabric and rock conforming to these requirements for construction indicated.

2.4.1 Bedding Material

Provide bedding material consisting of sand, gravel, or crushed rock, well graded, with a maximum particle size of 2 inches. Compose material of tough, durable particles. Allow fines passing the No. 200 standard sieve with a plasticity index less than six.

2.4.2 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Provide rock with a minimum specific gravity of 2.50. Do not permit the inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines.

2.5 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Conform to ASTM C33/C33M for fine aggregate grading with a maximum of 3 percent by weight passing ASTM D1140, No. 200 sieve, or 1-1/2 inch and no more than 2 percent by weight passing the No. 4 size sieve or coarse aggregate Size 57, 67, or 77.

2.6 PIPE CASING

2.6.1 Casing Pipe

ASTM A139/A139M, Grade B, or ASTM A252, Grade 2, smooth wall pipe. Match casing size to the outside diameter and wall thickness as indicated on the plans. Protective coating is not required on casing pipe.

2.6.2 Wood Supports

Locally available, rough, structural grade. Provide wood with nonleaching water-borne pressure preservative (ACA or CCA) and treatment conforming to AWPA P5 and AWPA C2, respectively. Secure wood supports to carrier pipe with stainless steel or zinc-coated steel bands.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Remove from the site any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the

limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the plans. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation

and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 2 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete.

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter.Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.5.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

3.3 SHORING

3.3.1 General Requirements

Submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.4 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and wasted materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.5 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.6 GROUND SURFACE PREPARATION

3.6.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.6.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.7 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Do not waste any satisfactory excavated material without specific

written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.8 BURIED TAPE AND DETECTION WIRE

3.8.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.8.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over it's entire length.Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.9 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9.1 Trench Backfill

Backfill trenches to the grade shown. Do not backfill the trench until all specified tests are performed.

3.9.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.9.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.9.1.3 Bedding and Initial Backfill

Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ASTM D698 maximum density.Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

a. Class I: Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.9.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, with satisfactory material. Place backfill material and compact as follows:

a. Roadways, Railroads, and Airfields: Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.9.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.10 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.10.1 Rip-Rap Construction

Construct rip-rap on filter fabric in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.10.1.1 Bedding Placement

Spread filter fabric bedding material uniformly to a thickness of at least 3 inches on prepared subgrade as indicated.

3.10.1.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.11 SUBGRADE PREPARATION

3.11.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Proof roll the existing subgrade of the parking areas with six passes of a 3-1/2 ton pneumatic-tired roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2-1/2 to 3-1/2 mph. Provide one-half of the passes made with the roller in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material and replace with select material.

3.11.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inches below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.11.3 Compaction

Finish compaction by pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 90 percent of laboratory maximum density.

3.11.3.1 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 6 inches of subgrade.

3.12 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.12.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.12.2 Capillary Water Barrier

Place a capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.12.3 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.13 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 4 inches and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.14 TESTING

Perform testing by a Government validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the

testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Government validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with ASTM D1556.

b. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.14.1 Fill and Backfill Material Gradation

One test per 500 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136.

3.14.2 In-Place Densities

a. One test per 1500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 1500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

3.14.3 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.14.4 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material to determine the optimum moisture and laboratory maximum density values. One representative test per 100 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.14.5 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.14.6 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 36 inches, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras

passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.15 DISPOSITION OF SURPLUS MATERIAL

Provide surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber as removed from Government property as directed by the Contracting Officer.

-- End of Section --

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section 01 57 50, TEMPORARY ENVIRONMENTAL CONTROLS. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer's Technical Representative immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer's Technical Representative in ample time to minimize interruption of the service.

3.2 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.3 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.4 DISPOSAL OF MATERIALS

3.4.1 Nonsaleable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

-- End of Section --

SECTION 31 31 16

SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

7 USC Section 136	Federal Insecticide, Fungicide, and Rodenticide Act

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Termiticide Application Plan; G

Termiticide application plan with proposed sequence of treatment work with dates and times. The termiticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area/volume treated, amount applied; and the name and state license number of the state certified applicator shall be included.

Termiticides; G

Manufacturer's label and Material Safety Data Sheet (MSDS) for termiticides proposed for use.

Foundation Exterior

Written verification that other site work will not disturb the treatment.

Utilities and Vents

Written verification that utilities and vents have been located.

Verification of Measurement

Written verification that the volume of termiticide used meets the application rate.

Application Equipment

A listing of equipment to be used.

Warranty; G

Copy of Contractor's warranty.

SD-06 Test Reports

Soil Moisture

Soil moisture test result.

Quality Assurance

Pest Management Report and copies of daily records signed by an officer of the Contractor.

SD-07 Certificates

Qualifications; G

Qualifications and state license number of the termiticide applicator.

1.3 QUALIFICATIONS

For the application of pesticides, the Contractor shall use the services of a subcontractor whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed. Termiticide applicators shall also be certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control.

1.4 SAFETY REQUIREMENTS

Formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Contracting Officer's Technical Representative, and fit the filling hose with a backflow preventer meeting local plumbing codes or standards. The filling operation shall be under the direct and continuous observation of a contractor's representative to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application. Dispose of used pesticide containers off Government property.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Termiticide material shall be delivered to the site in the original unopened containers bearing legible labels indicating the EPA registration number and manufacturer's registered uses. All other materials to be used on site for

the purpose of termite control shall be delivered in new or otherwise good condition as supplied by the manufacturer or formulator.

1.5.2 Storage

Materials shall be stored in designated areas and in accordance with manufacturer's labels. Termiticides and related materials shall be kept under lock and key when unattended.

1.5.3 Handling

Termiticides shall be handled in accordance with manufacturer's labels. Manufacturer's warnings and precautions shall be observed. Materials shall be handled preventing contamination by dirt, water, and organic material. Protect termiticides from sunlight as recommended by the manufacturer.

1.6 INSPECTION

Termiticides shall be inspected upon arrival at the job site for conformity to type and quality in accordance with paragraph TERMITICIDES. Each label shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or under appropriate regulations of the host county. Other materials shall be inspected for conformance with specified requirements. Unacceptable materials shall be removed from the job site.

1.7 WARRANTY

The Contractor shall provide a 5-year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Warranty shall include annual inspections of the buildings or building additions. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim, the Contractor shall:

a. Retreat the soil and perform other treatment as may be necessary for elimination of subterranean termite infestation;

b. Repair damage caused by termite infestation; and

c. Reinspect the building approximately 180 days after the retreatment.

1.8 QUALITY ASSURANCE

The Contractor shall comply with 7 USC Section 136 for requirements on contractor's licensing, certification, and record keeping. The Contractor shall maintain daily records using Pest Management Maintenance Record, DD Form 1532-1 and submit copies of records when requested by the Contracting Officer's Technical Representative.

Upon completion of this work, submit Pest Management Report. DD Form 1532 identifying target pest, type of operation, brand name and manufacturer of pesticide, formulation, concentration or rate of application used.

PART 2 PRODUCTS

2.1 TERMITICIDES

Termiticides shall be currently registered by the EPA or approved for such use by the appropriate agency of the host county. Non-repellant termiticide shall be selected for maximum effectiveness and duration after application. The selected termiticide shall be suitable for the soil and climatic conditions at the project site.

PART 3 EXECUTION

3.1 TECHNICAL REPRESENTATIVE

The certified installation pest management coordinator shall be the technical representative, shall be present at all meetings concerning treatment measures for subterranean termites, and may be present during treatment application. The command Pest Control Coordinator shall be contacted prior to starting work.

3.2 SITE PREPARATION

Work related to final grades, landscape plantings, foundations, or any other alterations to finished construction which might alter the condition of treated soils, shall be coordinated with this specification.

3.2.1 Ground Preparation

Food sources shall be eliminated by removing debris from clearing and grubbing and post construction wood scraps such as ground stakes, form boards, and scrap lumber from the site, before termiticide application begins.

3.2.2 Verification

Before work starts, the Contractor shall verify that final grades are as indicated and smooth grading has been completed in accordance with Section 31 00 00 EARTHWORK. Soil particles shall be finely graded with particles no larger than 1 inch and compacted to eliminate soil movement to the greatest degree.

3.2.3 Foundation Exterior

The Contractor shall provide written verification that final grading and landscape planting operations will not disturb treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures.

3.2.4 Utilities and Vents

The Contractor shall provide written verification that the location and identity of HVAC ducts and vents, water and sewer lines, and plumbing have been accomplished prior to the termiticide application.

3.3 SITE CONDITIONS

The following conditions shall determine the time of application.

3.3.1 Soil Moisture

Soils to be treated shall be tested immediately before application. Soil moisture content shall be tested to a minimum depth of 3 inches. The soil moisture shall be as recommended by the termiticide manufacturer. The termiticide will not be applied when soil moisture exceeds manufacturer's recommendations because termiticides do not adhere to the soil particles in saturated soils.

3.3.2 Runoff and Wind Drift

Termiticide shall not be applied during or immediately following heavy rains. Applications shall not be performed when conditions may cause runoff or create an environmental hazard. Applications shall not be performed when average wind speed exceeds 10 miles per hour. The termiticide shall not be allowed to enter water systems, aquifers, or endanger humans or animals.

3.3.2.1 Vapor Barriers and Waterproof Membranes

Termiticide shall be applied prior to placement of a vapor barrier or waterproof membrane.

3.3.2.2 Utilities and Vents

Prior to application, HVAC ducts and vents located in treatment area shall be turned off and blocked to protect people and animals from termiticide.

3.3.3 Placement of Concrete

Concrete covering treated soils shall be placed as soon as the termiticide has reached maximum penetration into the soil. Time for maximum penetration shall be as recommended by the manufacturer.

3.4 TERMITICIDE TREATMENT

The Contractor shall submit a Termiticide Application Plan for approval before starting the specified treatment.

3.4.1 Equipment Calibration and Tank Measurement

Immediately prior to commencement of termiticide application, calibration tests shall be conducted on the application equipment to be used and the application tank shall be measured to determine the volume and contents. These tests shall confirm that the application equipment is operating within the manufacturer's specifications and will meet the specified requirements. The Contractor shall provide written certification of the equipment calibration test results within 1 week of testing.

3.4.2 Mixing and Application

Formulating, mixing, and application shall be performed in the presence of the Contracting Officer's Technical Representative or the technical representative. A closed system is recommended as it prevents the termiticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation.

Prior to each day of use, the equipment used for applying termiticides shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.4.3 Treatment Method

For areas to be treated, the Contractor shall establish complete and unbroken vertical and/or horizontal soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Application shall not be made to areas which serve as crawl spaces or for use as a plenum air space.

3.4.3.1 Surface Application

Surface application shall be used for establishing horizontal barriers. Surface applicants shall be applied as a coarse spray and provide uniform distribution over the soil surface. Termiticide shall penetrate a minimum of 1 inch into the soil, or as recommended by the manufacturer.

3.4.3.2 Rodding and Trenching

Rodding and trenching shall be used for establishing vertical soil barriers. Trenching shall be to the depth of the foundation footing. Width of trench shall be as recommended by the manufacturer, or as indicated. Rodding or other approved method may be implemented for saturating the base of the trench with termiticide. Immediately after termiticide has reached maximum penetration as recommended by the manufacturer, backfilling of the trench shall commence. Backfilling shall be in 6 inch rises or layers. Each rise shall be treated with termiticide.

3.4.4 Sampling

The Contracting Officer's Technical Representative may draw from stocks at the job site, at any time and without prior notice, samples of the termiticides used to determine if the amount of active ingredient specified on the label is being applied.

3.5 VERIFICATION OF MEASUREMENT

Once termiticide application has been completed, tank contents shall be measured to determine the remaining volume. The total volume measurement of used contents for the application shall equal the established application rate for the project site conditions. The Contractor shall provide written verification of the measurements.

3.6 CLEAN UP, DISPOSAL, AND PROTECTION

Once application has been completed, the Contractor shall proceed with clean up and protection of the site without delay.

3.6.1 Clean Up

The site shall be cleaned of all material associated with the treatment measures, according to label instructions, and as indicated. Excess and waste material shall be removed and disposed off site.

3.6.2 Disposal of Termiticide

The Contractor shall dispose of residual termiticides and containers off Government property, and in accordance with label instructions and EPA criteria.

3.6.3 Protection of Treated Area

Immediately after the application, the area shall be protected from other use by erecting barricades and providing signage as required or directed. Signage shall be in accordance with Section 10 14 01 EXTERIOR SIGNAGE. Signage shall be placed inside the entrances to crawl spaces and shall identify the space as treated with termiticide and not safe for children and animals.

3.7 CONDITIONS FOR SATISFACTORY TREATMENT

3.7.1 Equipment Calibrations and Measurements

Where results from the equipment calibration and tank measurements tests are unsatisfactory, re-treatment will be required.

3.7.2 Testing

Should an analysis, performed by a third party, indicate that the samples of the applied termiticide contain less than the amount of active ingredient specified on the label, and/or if soils are treated to a depth less than specified or approved, re-treatment will be required.

3.7.3 Disturbance of Treated Soils

Soil and fill material disturbed after treatment shall be re-treated before placement of slabs or other covering structures.

3.7.4 Termites Found Within the Warranty Period

If live subterranean termite infestation or termite damage is discovered during the warranty period, the Contractor shall re-treat the site.

3.8 RE-TREATMENT

Where re-treatment is required, the Contractor shall comply with the requirements specified in paragraph WARRANTY.

-- End of Section --

SECTION 32 05 33

LANDSCAPE ESTABLISHMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush

ASTM INTERNATIONAL (ASTM)

ASTM D 2103	(2005) Standard Specification for Polyethylene Film and Sheeting
ASTM D 5851	(1995; R 2006) Planning and Implementing a Water Monitoring Program

1.2 DEFINITIONS

1.2.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.2.2 Stand of Turf

95 percent ground cover of the established species.

1.2.3 Planter Beds

A planter bed is defined as an area containing one or a combination of the following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, and a mulch topdressing excluding turf. Trees may also be found in planter beds.

1.3 RELATED REQUIREMENTS

Section 32 92 23 SEEDING applies to this section for installation of seed requirements, with additions and modifications herein.

Section 32 93 00 EXTERIOR PLANTS applies to this section for installation of trees, and shrubs, with additions and modifications herein.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

Deliver fertilizer, gypsum, and iron to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, and gypsum may be furnished in bulk with a certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Fertilizer, Lime, Iron, Mulch Storage

Material shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants.

1.5.2.2 Antidessicants Storage

Do not store with fertilizers or other landscape maintenance materials.

1.5.3 Handling

Do not drop or dump materials from vehicles.

1.6 MAINTENANCE

Provide instructions and procedures for watering; promotion of growth, including fertilizing, pruning, and mowing; and integrated pest management. O&M Manuals shall include pictures of planting materials cross referenced to botanical and common names, with a description of the normal appearance in each season.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

Fertilizer for grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.1.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus

8 percent available potassium

2.2 WATER

Source of water shall be approved by the Contracting Officer's Technical Representative, and be of suitable quality for irrigation. Use collected storm water or graywater when available.

2.3 MULCHES TOPDRESSING

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.3.1 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark or shredded hardwood from site when available. Biobased content shall be a minimum of 100 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application. Paper-based hydraulic mulch shall contain a minimum of 100 percent post-consumer recycled content. Wood-based hydraulic mulch shall contain a minimum of 100 percent recycled material.

2.4 PESTICIDES

Pesticides and herbicides are not permitted. Use black sheet polyethylene conforming to ASTM D 2103, minimum thickness 5/32 inch. Submit an Integrated Pest Management Plan, including weed and pest management strategies and proposed alternatives to herbicides and pesticides. Use biological pest controls as approved in the Plan.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include mowing, edging, fertilizing, watering, weeding, pruning, and stake and guy adjusting, for all newly installed landscape areas, unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

The Contractor shall police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Collected debris shall be promptly removed and disposed of at an approved disposal site.

3.1.2 Drainage System Maintenance

The Contractor shall remove all obstructions from surface and subsurface drain lines to allow water to flow unrestricted in swales, gutters, and catch basins. Remove grates and clear debris in catch basins. Open drainage channels are to be maintained free of all debris and vegetation at all times. Edges of these channels shall be clear of any encroachment by vegetation.

3.2 IRRIGATION ESTABLISHMENT PERIOD

The irrigation establishment period will commence on the date that inspection by the Contracting Officer's Technical Representative shows that the newly planted exterior plants have been installed per requirements and shall continue for a period of 90 days.

3.2.1 Water Restrictions

The Contractor shall abide by state, local or other water conservation regulations in force during the establishment period.

3.2.2 Fire Hydrants

To use a fire hydrant for irrigation, the Contractor shall obtain prior clearance from the Contracting Officer's Technical Officer and provide the tools and connections approved for use on fire hydrants. If a fire hydrant is used, Contractor shall provide a reduced pressure backflow preventer for each connection between hose and fire hydrant. Backflow preventer used shall be tested once per month by a certified backflow preventer tester.

3.2.3 Final Acceptance

Upon completion of the irrigation establishment period and final acceptance of groundcover and exterior plants, irrigation equipment shall be removed.

3.3 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the Contracting Officer shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period shall continue for a period of 90 days.

3.3.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed. Inspect areas once a week during the installation and establishment period and perform needed maintenance promptly.

3.3.2 Promotion of Growth

Groundcover shall be maintained in a manner that promotes proper health, growth, natural color. Turf shall have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, and overseed and perform other operations necessary to promote growth, as approved by Contracting Officer's Technical Representative and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.3.3 Mowing

3.3.3.1 Turf

Turf shall be mowed at a uniform finished height. Mow turfed area to a minimum average height of 3-4 inches when average height of grass becomes 6 inches for spring/summer maintenance and to a minimum average height of 3-4 inches when the average height of grass reaches 5 inches for fall and winter maintenance. The height of turf is measured from the soil. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area shall be picked up and disposed. Adjacent paved areas shall be swept/vacuumed clean.

3.3.4 Turf Edging and Trimming

Perimeter of planter bed edges, sidewalks, driveways, curbs, and other paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas such as an edge between turfgrass and a planter bed. Care shall be exercised to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf's mowed. Care shall be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas may be utilized as a temporary means to avoid injury to tree trunks. At the end of the plant establishment period Contractor will be responsible for removing all protective tree collars.

3.3.5 Post-Fertilizer Application

Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies shall be determined by the laboratory soil analysis results the requirements of the particular turf species. Organic fertilizer shall be used. In the event that organic fertilizer is not producing the desired effect, the Contractor shall contract the Contracting Officer's Technical Representative for approval prior to the use of a synthetic type of fertilizer. Fertilizer shall be applied by approved methods in accordance with the manufacturer's recommendations.

3.3.6 Turf and Plant Watering

The Contractor shall perform watering in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, State, and local water agencies and authorities directives. Watering shall be performed regulary from planting to the end of the establishment period. The Contractor shall be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. The Contractor shall abide by state, local or other water conservation regulations or restrictions in force during the establishment period.

3.3.7 Turf Clearance Area

Trees located in turf areas shall be maintained with a growth free clearance of 24 inches from the tree trunk base. The use of mechanical weed whips to accomplish the turf growth free bed area is prohibited.

3.3.8 Replanting

Replant in accordance with Section 32 92 19 SEEDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

3.3.9 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf. Final acceptance of grass areas will be based upon a stand of 95 percent groundcover of established species.

3.3.10 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer's Technical Representative.

3.4 EXTERIOR PLANT ESTABLISHMENT PERIOD

The exterior plant establishment period will commence on the date that inspection by the Contracting Officer shows that the new plants furnished under this contract have been satisfactorily installed and shall continue for a period of 90 days.

3.4.1 Frequency of Maintenance

Begin maintenance immediately after plants have been installed. Inspect exterior plants at least biweekly during the installation and establishment period and perform needed maintenance promptly.

3.4.2 Promotion of Plant Growth and Vigor

Water, prune, fertilize, mulch, adjust stakes, guys and turnbuckles, eradicate weeds and perform other operations necessary to promote plant growth, and vigor.

3.4.3 Planter Bed Maintenance

Planter beds shall be weeded, fertilized, irrigated, kept pest free, turf free, pruned, and mulch levels maintained. Planter beds will not be allowed to encroach into turf areas. A definite break shall be maintained between turf areas and planter beds. Fertilize exterior planting materials to promote healthy plant growth without encouraging excessive top foliar growth. Remove noxious weeds common to the area from planting areas by mechanical means.

3.4.3.1 Shrub Selective Maintenance

In addition to the above requirements, shrubs shall be selectively pruned, and shaped for health and safety when the following conditions exist: Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel; Remove dead, damaged or diseased branches or limbs; where shrub growth obstructs pedestrian walkways; where shrub growth is found growing against or over structures; where shrub growth permits concealment of unauthorized persons. All pruning debris shall be disposed of in a proper manner.

3.4.3.2 Tree Maintenance

Tree maintenance shall include adjustment of stakes, ties, guy supports and turnbuckles, watering, fertilizing, pest control, mulching, pruning for health and safety and fall leaf cleanup. Fertilize exterior trees to promote healthy plant growth without encouraging excessive top foliar growth. Stakes, ties, guy supports and turnbuckles shall be inspected and adjusted to avoid girdling and promote natural development. All trees within the project boundaries, regardless of caliper, shall be selectively pruned for safety and health reasons. These include but are not limited to removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced. Pruning of all trees including palm trees shall be accomplished by or in the presence of a certified member of the International Society of Arboriculture and in accordance with ANSI Z133.1. All pruning debris generated shall be disposed of in a proper manner.

3.4.4 Removal of Dying or Dead Plants

Remove dead and dying plants and provide new plants immediately upon commencement of the specified planting season, and replace stakes, guys, mulch and eroded earth mound water basins. No additional plant establishment period will be required for replacement plants beyond the original warranty period. A tree shall be considered dying or dead when the main leader has died back, or a minimum of 20 percent of the crown has died. A shrub or ground cover shall be considered dying or dead when a minimum of 20 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine the cause for dying plant material and shall provide recommendations for replacement. The Contractor shall determine the cause for dying plant material and provide recommendations for replacement.

3.4.5 Tracking of Unhealthy Plants

Note plants not in healthy growing condition, as determined by the Contracting Officer's Technical Representative, and as soon as seasonal conditions permit, remove and replace with plants of the same species and sizes as originally specified. Install replacement plantings in accordance with Section 32 93 00 EXTERIOR PLANTS.

3.4.6 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final inspection will be based upon satisfactory health and growth of plants and on the following:

3.4.6.1 Total Plants on Site

Plants have been accepted and required number of replacements have been installed.

3.4.6.2 Mulching and Weeding

Planter beds and earth mound water basins are properly mulched and free of weeds.

3.4.6.3 Tree Supports

Stakes guys and turnbuckles are in good condition.

3.4.6.4 Remedial Work

Remedial measures directed by the Contracting Officer's Technical Representative to ensure plant material survival and promote healthy growth have been completed.

3.4.7 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer' Technical Representative.

3.5 FIELD QUALITY CONTROL

3.5.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations shall be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Results of site observation visits shall be submitted to the Contracting Officer's Technical Representative within 7 calendar days of each site observation visit.

3.5.2 Plant Quantities

The Contractor shall provide Contracting Officer's Technical Representative with the number of plant quantities. In addition, provide total exterior area of hardscape and landscaping such as turf and total number of shrubs.

3.5.3 Tree Staking and Guying Removal

The Contractor shall remove all stakes and guys from all project trees at the end of the establishment period.

-- End of Section --

SECTION 32 10 00

BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 230	(1968; R 2000) Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures
AASHTO T 30	(2007) Mechanical Analysis of Extracted Aggregate

ASTM INTERNATIONAL (ASTM)

ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2172	(2005) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2005) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

STATE OF GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT	(2001) Standard Specifications, Construction of Roads and Bridges

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Local/Regional Materials; (LEED)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-06 Test Reports

Trial batch reports;

Mix design;

Asphalt concrete;

Density;

Thickness;

Straightedge test;

Submit reports for testing specified under paragraph entitled "Field Quality Control."

SD-07 Certificates

Asphalt concrete;

Submit certificates, signed by the producer, that paving materials and incidental construction items conform to specification requirements.

1.3 QUALITY ASSURANCE

1.3.1 Regulatory Requirements

Provide work and materials in accordance with applicable requirements of GDOT. Sections and Paragraphs 400 and 828 mentioned herein refer to those specifications. Paragraphs in GDOT entitled "Measurement" and "Payment" shall not apply.

1.3.2 Modification of References

Where term "Engineer" is used in GDOT it shall be construed to mean Contracting Officer's Technical Representative. Where term "state" is used, it shall mean "Federal Government".

1.3.3 Trial Batch

Submit current bituminous design reports for all mix types proposed for use on the project.

1.3.4 Mix Design

Submit results of laboratory tests performed on each mix design. Testing shall have been accomplished not more than one year prior to date of material placement.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not produce or place bituminous concrete when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.

1.5 SUSTAINABLE DESIGN REQUIREMENTS

1.5.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE

Provide asphalt concrete in accordance with the applicable requirements of the GDOT, except where specified otherwise. Recycled asphalt pavement material may be used as permitted by GDOT.

2.2 BASE COURSE

GDOT, materials for construction of the base course shall be in accordance with Section 815.2.02.

2.3 SURFACE COURSE

GDOT, materials for construction of the surface course shall be in accordance with Section 828.2.02Type 9.5 mm SMA.

2.4 STRIPING

GDOT, materials for paint striping shall be in accordance with Section 652 and Section 870.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Excavation and Filling

Excavation and filling to establish elevation of subgrade is specified in Section 31 00 00 EARTHWORK.

3.2 CONSTRUCTION

Provide construction in accordance with the applicable requirements of the GDOT, except where indicated or specified otherwise.

3.2.1 Subgrade

Preparation of subgrade shall be in accordance with Section 31 00 00 EARTHWORK. Verify compacted subgrade, granular base, or stabilized soil is acceptable and ready to support paving and imposed loads.

3.2.2 Base Course

GDOT, methods of construction of the base course shall be in accordance with Section 310.

3.2.3 Surface Course

GDOT, methods of construction of the surface course shall be in accordance with Section 400. Placement will not be permitted unless the Contractor has a working asphalt thermometer on site.

3.2.4 Striping

GDOT, provide paint striping in accordance with Section 870. Allow bituminous pavement to cure for at least 21 days before paint is applied. Pavement shall be thoroughly clean and entirely free of loose sand, stones, dust, oil, grease, water, and other substances that will be deleterious to the paint or will adversely affect the adhesion of the paint. Do not apply paint during high wind (over 15 miles per hour) or high humidity (over 70 percent). Apply paint only when ambient temperature is 40 degrees F or above and rising but not more than 95 degrees F. Dimensions and arrangement of striping shall be as indicated. Apply paint to a wet film thickness of 0.015 inch by means of conventional traffic line striping equipment. Traffic shall not be permitted to use the painted areas for a minimum of 30 minutes after painting of lines has been completed.

3.3 FIELD QUALITY CONTROL

Sample shall be taken by Contractor as specified herein. Contractor shall replace pavement where sample cores have been removed. Submit 2 pavement cores when using the in-place nuclear density method.

3.3.1 Testing

3.3.1.1 Bituminous Mix Testing

Take two samples per day per mix type at plant or from truck. Test uncompacted mix for extraction in accordance with ASTM D 2172 and sieve analysis in accordance with AASHTO T 30. Test samples for stability and flow in accordance with ASTM D 1559. When two consecutive tests fail to meet requirements of specifications, cease placement operations and test a new trial batch prior to resumption of placement operations. Submit 2 per day of each mix type. When two tests on uncompacted mix fail submit new trial batch for approval.

3.3.1.2 Testing of Pavement Course

a. Density: Determine density of pavement by testing cores obtained from the surface course in accordance with AASHTO T 230. Take three cores at location designated by Contracting Officer's Technical Representative for each 200 tons, or fraction thereof, of asphalt placed. Deliver cores undisturbed and undamaged to laboratory and provide test results within 48 hours of each day placement of paving materials.

b. Thickness: Determine thickness of the surface course from cores taken for density test.

c. Straightedge Test: Test compacted surface course with a straightedge as work progresses. Apply straightedge parallel with and at right angles to center line after final rolling. Variations in surface course surface shall not be more than 1/4 from the lower edge of the 10 foot straightedge.

d. Noncompliant pavement shall be replaced or corrected as directed by the Contracting Officer's Technical Representative at no additional expense to the Government.

3.4 WASTE MANAGEMENT

Protect excess material from contamination and return to manufacturer, or reuse on-site for walkways, patching, ditch beds, speed bumps, or curbs.

-- End of Section --

SECTION 32 16 13

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(2005) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

ASTM INTERNATIONAL (ASTM)

ASTM A 185/A 185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 615/A 615M	(2007) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2005a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 171	(2003) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(2007) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 309	(2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2006) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1751	(2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

ASTM D 5893	(2004) Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete;

Copies of certified delivery tickets for all concrete used in the construction.

SD-06 Test Reports

Field Quality Control;

Copies of all test reports within 24 hours of completion of the test.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F.Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F at any time.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer's Technical Representative shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.1.1 Slump

The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143/C 143M.

2.1.2 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615/A 615M. Wire mesh reinforcement shall conform to ASTM A 185/A 185M.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

Joint sealant, cold-applied shall conform to ASTM C 920 or ASTM D 5893.

2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted as directed.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends

shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of 1/4 inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.

3.4.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.4.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D 1752 or building paper. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant. Joint sealant shall be gray or stone in color. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.4.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.5 CURING AND PROTECTION

3.5.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be

on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.5.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.5.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.5.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet/gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing

compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.5.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.5.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.6 FIELD QUALITY CONTROL

3.6.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.6.2 Concrete Testing

3.6.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.6.2.2 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.6.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section.

3.6.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.7 SURFACE DEFICIENCIES AND CORRECTIONS

3.7.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.7.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.7.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

3.7.4 Corrections

Noncompliant concrete shall be removed and replaced or corrected as directed by the Contracting Officer's Technical Representative at no additional expense to the Government.

-- End of Section --

SECTION 32 17 24.00 10

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952	(Rev E) Paint, Traffic and Airfield Markings, Waterborne

1.2 SYSTEM DESCRIPTION

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Submit lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.2.1 Paint Application Equipment

1.2.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified.Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.2.1.2 Hand-Operated, Push-Type Machines

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.2.2 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.2.3 Surface Preparation Equipment

1.2.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.2.3.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

1.2.4 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.2.4.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.2.4.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradable residue.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing

1.4 QUALITY ASSURANCE

1.4.1 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.4.2 Maintenance of Traffic

1.4.2.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.5 DELIVERY, STORAGE, AND HANDLING

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.6 ENVIRONMENTAL REQUIREMENTS

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, parking areas, and streets shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Submit certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers in the presence of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Thoroughly clean surfaces to be marked before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Remove existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.2 Cleaning Concrete Curing Compounds

On new portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified. Provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

a. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet/gallon.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Raised Reflective Markers

Prefabricated markers shall be aligned carefully at the required spacing and permanently fixed in place by means of epoxy resin adhesives. To insure good bond, pavement in areas where markers will be set shall be thoroughly cleaned by sandblasting and use of compressed air prior to applying adhesive.

3.2.3 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the

specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

3.3 MARKING REMOVAL

Pavement marking, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

-- End of Section --

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 602	(2007) Agricultural Liming Materials
ASTM D 4427	(2007) Peat Samples by Laboratory Testing
ASTM D 4972	(2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch;

Fertilizer;

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Sulfur, Iron and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer sulphur, iron and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer, Sulfur, Iron and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer's Technical Representative.

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	Feb 15 - June 30
Season 2	Nov 1 - Jan 31
Temporary Seeding 1	Aug 15 - Mar 31
Temporary Seeding 2	Apr 1 - July 15

2.1.3 Seed Purity

Botanical Name	Common Name	Min. Percent Pure Seed
Cynodon Daclylon	Common Bermuda (Hulled or Unhulled)	100%
Lolium Mutliflorum	Annual Ryegrass	100%
Secale Cereale	Rye	100%
Panicum Fasciculalum	Browntop Millet	100%

2.1.4 Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
Season 1	Common Bermuda (Hulled)	100%
Season 2	Common Bermuda (Unhulled)	60%
	Rye	40%
Temporary Seeding 1	Annual Ryegrass	100%
Temporary Seeding 2	Browntop Millet	100%

Proportion seed mixtures by weight. Temporary seeding must later be replaced by Season 1 or Season 2 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 or Season 2 apply for temporary seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade hydrate or burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 110 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

20 percent available nitrogen
10 percent available phosphorus
10 percent available potassium

2.4.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the following minimum percentages, by weight, of plant food nutrients.

20 percent available nitrogen
10 percent available phosphorus
10 percent available potassium

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.5.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.6 WATER

Source of water shall be approved by Contracting Officer's Technical Representative and of suitable quality for irrigation, containing no elements toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of off-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters or soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer's Technical Representative. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer's Technical Representative stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be broadcasted and drop seeding or hydroseeding.

3.2.2.1 Broadcast and Drop Seeding

Seed shall be uniformly broadcast at the rate of 1500pounds per acre. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.2.2 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of 1500pounds per acre. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.2.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.2.3.3 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer's Technical Representative.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RENOVATION OF EXISTING TURF AREA

3.4.1 Overseeding

Apply seed in accordance with applicable portions of paragraph entitled "Seed Application Method" at rates in accordance with paragraph entitled "Seed Composition."

3.5 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 32 93 00

EXTERIOR PLANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance
ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush
ANSI Z60.1	(1996) Nursery Stock

ASTM INTERNATIONAL (ASTM)

ASTM A 580/A 580M	(2006) Standard Specification for Stainless Steel Wire
ASTM D 4972	(2001; R 2007) pH of Soils
ASTM D 5852	(2000; R 2007) Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
ASTM D 6629	(2001; R 2007) Selection of Methods for Estimating Soil Loss by Erosion

L.H. BAILEY HORTORIUM (LHBH)

LHBH	(1976) Hortus Third

1.2 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, Section 32 92 23 SEEDING, and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Organic Mulch Materials

Mulch;

Fertilizer;

Weed control fabric;

Staking Material
Ground Stakes;

Metal anchors;

SD-06 Test Reports

Topsoil composition tests;

SD-07 Certificates

Nursery certifications;

Indicate names of plants in accordance with the LHBH, including type, quality, and size.

1.4 QUALITY ASSURANCE

1.4.1 Topsoil Composition Tests

Commercial test from an independent testing laboratory including basic soil groups (moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D 4972), soil salinity), secondary nutrient groups (calcium, magnesium, sodium, Sodium Absorption Ratio (SAR)), micronutrients (zinc, manganese, iron, copper), toxic soil elements (boron, chloride, sulfate), cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being transplanted. Soil required for each test shall include a maximum depth of 18 inches of approximately 1 quart volume for each test. Areas sampled should not be larger than 1 acre and should contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.

1.4.2 Nursery Certifications

a. Indicate on nursery letterhead the name of plants in accordance with the LHBH, including botanical common names, quality, and size.

b. Inspection certificate.

c. Mycorrhizal fungi inoculum for plant material treated

1.4.3 State Landscape Contractor's License

Construction company shall hold a landscape contractors license in the state of Georgia and have a minimum of five years landscape construction experience. Submit copy of license and three references for similar work completed in the last five years.

1.4.4 Not used

1.4.5 Not used

1.4.6 Not used

1.4.7 Pre-Installation Meeting

Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this section. Review conditions of operations, procedures and coordination with related work. Agenda shall include the following:

a. Tour, inspect, and discuss conditions of planting materials.

b. Review planting schedule and maintenance.

c. Review required inspections.

d. Review environmental procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Branched Plant Delivery

Deliver with branches tied and exposed branches covered with material which allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.

1.5.1.2 Soil Amendment Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulfur, iron, and lime may be furnished in bulk with a certificate indicating the above information. Store in dry locations away from contaminates.

1.5.1.3 Plant Labels

Deliver plants with durable waterproof labels in weather-resistant ink. Provide labels stating the correct botanical and common plant name and variety as applicable and size as specified in the list of required plants. Attach to plants, bundles, and containers of plants. Groups of plants may be labeled by tagging one plant. Labels shall be legible for a minimum of 60 days after delivery to the planting site.

1.5.2 Storage

1.5.2.1 Plant Storage and Protection

Store and protect plants not planted on the day of arrival at the site as follows:

a. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted.

b. Heel-in bare root plants.

c. Protect balled and burlapped plants from freezing or drying out by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.

d. Keep plants in a moist condition until planted by watering with a fine mist spray.

e. Do not store plant material directly on concrete or bituminous surfaces.

1.5.2.2 Fertilizer, Gypsum, pH Adjusters and Mulch Storage

Store in dry locations away from contaminants.

1.5.2.3 Topsoil

Prior to stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.4 Weed Control Fabric

Store materials on site in enclosures or under protective covering in dry location. Store under cover out of direct sunlight. Do not store materials directly on ground.

1.5.3 Handling

Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped bare root, balled and potted, processed balled and/or in-ground fabric bag grown plants carefully to avoid damaging or breaking the earth ball or root structure. Do not handle plants by the trunk or stem. Remove damaged plants from the site.

1.5.4 TIME LIMITATION

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum of 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum of 24 hours.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.

1.6.1 Planting Dates

1.6.1.1 Deciduous Material

Deciduous material from 3/1 to 5/15 for spring planting and from 10/1 to 11/30 for fall planting.

1.6.1.2 Evergreen Material

Evergreen material from 3/1 to 4/30 for spring planting and from 9/1 to 9/30 for fall planting.

1.6.2 Restrictions

Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit

1.7 GUARANTEE

All plants shall be guaranteed for one year beginning on the date of inspection by the Contracting Officer's Technical Representative to commence the plant establishment period, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Government or by weather conditions unusual for the warranty period.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Regulations and Varieties

Existing trees and shrubs to remain shall be protected and a planting plan be arranged around them.Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Each plant or group of planting shall have a "key" number indicated on the nursery certifications of the plant schedule. Furnish plants, including turf grass, grown under climatic conditions similar to those in the locality of the project. Plants specified shall be low maintenance varieties, tolerant of site's existing soils and climate. Spray plants budding into leaf or having soft growth with an antidesiccant before digging. Plants of the same specified size shall be of uniform size and character of growth. Plants shall be chosen with their mature size and growth habit in mind to avoid over-planting and conflict with other plants, structures or underground utility lines. All plants shall comply with all Federal and State Laws requiring inspection for plant diseases and infestation.

2.1.2 Shape and Condition

Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having a healthy, normal, and undamaged root system.

2.1.2.1 Deciduous Trees and Shrubs

Symmetrically developed and of uniform habit of growth, with straight boles or stems, and free from objectionable disfigurements.

2.1.2.2 Evergreen Trees and Shrubs

Well developed symmetrical tops with typical spread of branches for each particular species or variety.

2.1.3 Plant Size

Minimum sizes measured after pruning and with branches in normal position, shall conform to measurements indicated, based on the average width or height of the plant for the species as specified in ANSI Z60.1. Plants larger in size than specified may be provided with approval of the Contracting Officer's Technical Representative. When larger plants are provided, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.

2.1.4 Root Ball Size

All box-grown, field potted, field boxed, collected, plantation grown, bare root, balled and burlapped, container grown, processed-balled, and in-ground fabric bag-grown root balls shall conform to ANSI Z60.1. All wrappings and ties shall be biodegradable. Root growth in container grown plants shall be sufficient to hold earth intact when removed from containers. Root bound plants will not be accepted.

2.1.4.1 Mycorrhizal fungi inoculum

Before shipment, root systems shall contain mycorrhizal fungi inoculum.

2.1.5 Growth of Trunk and Crown

2.1.5.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANSI Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.

2.1.5.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANSI Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.5.3 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANSI Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

2.2 TOPSOIL

2.2.1 Existing Soil

Modify to conform to requirements specified in paragraph entitled "Composition" of specification Section 32 92 19, SEEDING.

2.3 SOIL CONDITIONERS

Provide as found in paragraph entitled "Soil Conditioners", Section 32 92 19, SEEDING.

2.4 PLANTING SOIL MIXTURES

100 percent topsoil as specified in Section 32 92 19, SEEDING.

2.5 FERTILIZER

Fertilizer for grasses is not permitted.
Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.5.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus
8 percent available potassium

2.5.2 Fertilizer Tablets

Organic, plant tablets composed of tightly compressed fertilizer chips forming a tablet that is insoluble in water, is designed to provide a continuous release of nutrients for at least 24 months and contains the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus
8 percent available potassium

2.6 WEED CONTROL FABRIC

2.6.1 Roll Type Polypropylene or Polyester Mats

Fabric shall be woven, needle punched or non-woven and treated for protection against deterioration due to ultraviolet radiation. Fabric shall be minimum 99 percent opaque to prevent photosynthesis and seed germination from occurring, yet allowing air, water and nutrients to pass thru to the

roots. Minimum weight shall be 5 ounces per square yard with a minimum thickness of 20 mils with a 20 year (minimum) guarantee.

2.7 MULCH

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.7.1 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark or shredded hardwood from site when available. Biobased content shall be a minimum of 100 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application. Paper-based hydraulic mulch shall contain a minimum of 100 percent post-consumer recycled content. Wood-based hydraulic mulch shall contain a minimum of 100 percent recycled material.

2.8 STAKING AND GUYING MATERIAL

2.8.1 Staking Material

2.8.1.1 Tree Support Stakes

Rough sawn hard wood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Stakes shall be minimum 2 inches square or 2 1/2 inch diameter by 8 feet long, pointed at one end.

2.8.1.2 Ground Stakes

100 percent post-consumer recycled content plastic, 2 inches square are by 3 feet long, pointed at one end.

2.8.2 Guying Material

2.8.2.1 Guying Wire

12 gauge annealed galvanized steel, ASTM A 580/A 580M.

2.8.2.2 Guying Cable

Minimum five-strand, 3/16 inch diameter galvanized steel cable.

2.8.3 Hose Chafing Guards

New or used 2 ply 3/4 inch diameter reinforced rubber or plastic hose, black or dark green, all of same color.

2.8.4 Flags

White surveyor's plastic tape, 12 inches long, fastened to guying wires or cables.

2.8.5 Turnbuckles

Galvanized or cadmium-plated steel with minimum 3 inch long openings fitted with screw eyes. Eye bolts shall be galvanized or cadmium-plated steel with one inch diameter eyes and screw length 1 1/2 inches, minimum.

2.8.6 Metal Anchors

2.8.6.1 Driven Anchors

Malleable iron, arrow shaped, galvanized, sized as follows:

Tree Caliper	Anchor Size
2 inches and under	3 inches
3 to 6 inches	4 inches
6 to 8 inches	6 inches
8 to 10 inches	8 inches
10 to 12 inches	10 inches

2.8.6.2 Screw Anchors

Steel, screw type with welded-on 3 inch round helical steel plate, minimum 3/8 inch diameter, 15 inches long.

2.9 NOT USED

2.10 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.10.1 Erosion Control Blanket

100 percent agricultural straw stitched with a degradable nettings, designed to degrade within 18 months.

2.10.2 Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.10.3 Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inch square.

2.10.4 Not used

2.10.5 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

2.11 WATER

Source of water to be approved by Contracting Officer's Technical Representative and suitable quality for irrigation and shall not contain elements toxic to plant life, including acids, alkalis, salts, chemical

pollutants, and organic matter. Use collected storm water or graywater when available.

2.12 NOT USED

2.13 SOURCE QUALITY CONTROL

The Contracting Officer's Technical Representative will inspect plant materials at the project site and approve them. Tag plant materials for size and quality.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide soil preparation, fertilizing, tree, shrub, and planting, staking and guying, weed control fabric,, erosion control material and installation and a mulch topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 PREPARATION

3.2.1 Protection

Protect existing and proposed landscape features, elements, and sites from damage or contamination. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than the drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.

3.2.2 Layout

Stake out approved plant material locations and planter bed outlines on the project site before digging plant pits or beds. The Contracting Officer's Technical Representative reserves the right to adjust plant material locations to meet field conditions. Do not plant closer than 36 inches to a building wall, pavement edge, fence or wall edge and other similar structures.

3.2.3 Erosion Control

Provide erosion control and seeding with native plant species to protect slopes.

3.2.4 Soil Preparation

3.2.4.1 pH Adjuster Application Rates

Apply pH adjuster at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.4.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.4.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.3 PLANT BED PREPARATION

Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Depth of plant pit excavation shall be as indicated and provide proper relation between top of root ball and finished grade. Install plant material as specified in paragraph entitled "Plant Installation." Do not install trees within 10 feet of any building walls.

3.4 PLANT INSTALLATION

3.4.1 Individual Plant Pit Excavation

Excavate pits at least twice as large in diameter as the size of ball or container to depth shown.

3.4.2 Plant Beds with Multiple Plants

Excavate plant beds continuously throughout entire bed as outlined to depth shown.

3.4.3 Handling and Setting

Move plant materials only by supporting the root ball. Set plants on hand compacted layer of prepared backfill soil mixture 6 inches thick and hold plumb in the center of the pit until soil has been tamped firmly around root ball. Set plant materials, in relation to surrounding finish grade, level to the depth at which they were grown in the nursery, collecting field or container. Replace plant material whose root balls are cracked or damaged either before or during the planting process.

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas.

3.4.3.1 Balled and Burlapped Stock

Backfill with prepared soil mixture and topsoil to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials from the top a minimum 1/3 depth from the top of the rootball. Tamp and complete backfill, place mulch topdressing, and water. Remove wires and non-biodegradable materials from plant pit prior to backfill operations.

3.4.3.2 Bare-Root Stock

Plant so roots are arranged in a natural position. Place roots in water a minimum of 30 minutes prior to planting. Carefully work prepared soil mixture and topsoil among roots. Tamp remainder of backfill, place mulch topdressing and water.

3.4.3.3 Container Grown Stock

Remove from container and prevent damage to plant or root system.

3.4.4 Earth Mounded Watering Basin for Individual Plant Pits

Form with topsoil around each plant by replacing a mound of topsoil around the edge of each plant pit. Watering basins shall be 6 inches deep for trees and 4 inches deep for shrubs. Eliminate basins around plants in plant beds containing multiple plants.

3.4.5 Weed Control Fabric Installation

Remove grass and weed vegetation, including roots, from within the area enclosed by edging. Completely cover areas enclosed by edging with specified weed control fabric prior to placing mulch layer. Overlap cut edges 6 inches.

3.4.6 Erosion Control Material

Install in accordance with manufacturer's instructions.

3.4.7 Placement of Mulch Topdressing

Place specified mulch topdressing on top of weed control fabric covering total area enclosed by edging. Place mulch topdressing to a depth of 3 inches.

3.4.8 Mulch Topdressing

Provide mulch topdressing over entire planter bed surfaces and individual plant surfaces including earth mound watering basin around plants to a depth of 3 inches after completion of plant installation and before watering. Keep mulch out of the crowns of shrubs. Place mulch a minimum 6 inches away from trunk of shrub or tree. Place on top of any weed control fabric.

3.4.9 Fertilization

3.4.9.1 Fertilizer Tablets

Place fertilizer planting tablets evenly spaced around the plant pits to the manufacturer's recommended depth.

3.4.9.2 Granular Fertilizer

Apply granular fertilizer as a top coat prior to placing mulch layer and water thoroughly.

3.4.10 Watering

Start watering areas planted as required by temperature and wind conditions. Slow deep watering shall be used. Apply water at a rate sufficient to

ensure thorough wetting of soil to a depth of 12 inches without run off or puddling. Watering of other plant material or adjacent areas shall be prevented.

3.4.11 Staking and Guying

3.4.11.1 Staking

Stake plants with the number of stakes indicated complete with double strand of 12 gage guy wire as detailed. Attach guy wire half the tree height but not more than 5 feet high. Drive stakes to a depth of 2 1/2 to 3 feet into the ground outside the plant pit. Do not injure the root ball. Use hose chafer guards where guy wire comes in contact with tree trunk.

3.4.11.2 Guying

Guy plants as indicated.

3.4.11.3 Chafing Guards

Use hose chafing guards, as specified where guy wire cable will contact the plant.

3.4.11.4 Deadmen

Place deadmen minimum 18 inches below ground surface. Place equal distance from tree trunk and around the plant pit.

3.4.11.5 Wood Ground Stakes

Drive wood ground stakes into firm ground outside of plant pit with top of stake flush with ground. Place equal distance from tree trunk and around the plant pit.

3.4.11.6 Iron Anchors

Drive malleable iron anchors into firm ground outside of plant pit a minimum 30 inches below finish grade. Place equal distance from tree trunk and around the plant pit.

3.4.11.7 Steel Screw Anchors

Insert steel screw anchors as recommended in manufacturer's data. Place equal distance from tree trunk and around the plant pit.

3.4.11.8 Flags

Securely fasten flags on each guy wire and cable approximately two-thirds of the distance up from ground level.

3.4.12 Pruning

Prune in accordance with safety requirement of ANSI Z133.1.

3.4.12.1 Trees and Shrubs

Remove dead and broken branches. Prune to correct structural defects only. Retain typical growth shape of individual plants with as much height and spread as practical.Do not cut central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars shall remain in place. Pruning shall be accomplished by trained and experienced personnel and shall be accordance with ANSI A300.

3.4.12.2 Wound Dressing

Do not apply tree wound dressing to cuts.

3.5 RESTORATION AND CLEAN UP

3.5.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.5.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite at an approved landfill, recycling center, or composting center. Adjacent paved areas shall be cleared.

-- End of Section --

SECTION 33 11 00

WATER DISTRIBUTION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2004) Hypochlorites
AWWA B301	(2004) Liquid Chlorine
AWWA C104/A21.4	(2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2003) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153/A21.53	(2006) Ductile-Iron Compact Fittings for Water Service
AWWA C500	(2002; R 2003) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(2005) Dry-Barrel Fire Hydrants
AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C800	(2005) Underground Service Line Valves and Fittings
AWWA C900	(2007) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASME B16.26	(2006) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

ASTM INTERNATIONAL (ASTM)

ASTM B 61	(2002) Standard Specification for Steam or Valve Bronze Castings
ASTM B 62	(2002) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(2004e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2774	(2004e1) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 402	(2005) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 325	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 49	(2003) Hazardous Chemicals Data
NFPA 704	(2006) Identification of the Hazards of Materials for Emergency Response

UNDERWRITERS LABORATORIES (UL)

UL 246	(1993; Rev thru Dec 1998) Hydrants for Fire-Protection Service
UL 262	(2004) Standard for Gate Valves for Fire-Protection Service

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)

1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 6 inch lines of ductile-iron or polyvinyl chloride (PVC) plastic pipe. Provide water main accessories, gate valves as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines indicated as 2-1/2 inch lines from water distribution main to building service at the point indicated. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances as specified and where indicated.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping Materials;

Water distribution main piping, fittings, joints, valves, and coupling;

Hydrants;

Valve boxes;

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

SD-06 Test Reports

Bacteriological Disinfection; G

Test results from commercial laboratory verifying disinfection

SD-07 Certificates

Fire hydrants;

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.4.2.1 Miscellaneous Plastic Pipe and Fittings

Handle Polyvinyl Chloride (PVC), pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Ductile-Iron Piping

a. Pipe and Fittings: Pipe, AWWA C151/A21.51, Pressure Class 150. Fittings, AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104/A21.4, standard thickness.

b. Joints and Jointing Material:

(1) Joints: Joints for pipe and fittings shall be push-on joints or mechanical joints.

(2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111/A21.11.

(3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111/A21.11.

2.1.1.2 Polyvinyl Chloride (PVC) Plastic Piping

a. Pipe and Fittings: Pipe, AWWA C900, shall be plain end or gasket bell end, Pressure Class 150 (DR 18) with cast-iron-pipe-equivalent OD.

b. Fittings for PVC pipe: Fittings shall be gray iron or ductile iron, AWWA C110/A21.10 or AWWA C153/A21.53, and have cement-mortar lining, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe specified in this paragraph. Iron fittings and specials shall be cement-mortar lined in accordance with AWWA C104/A21.4.

c. Joints and Jointing Material: Joints for pipe shall be push-on joints, ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints ASTM D 3139, or compression-type joints/mechanical joints, ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe, ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints.

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, (2) AWWA C509 shall be nonrising stem type with mechanical-joint ends or resilient-seated gate valves 3 to 12 inches in size, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have 0-ring stem seals.Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.

2.1.2.2 Fire Hydrants

Dry-barrel type. Paint hydrants with at least one coat of primer and two coats of red enamel paint.

a. Dry-Barrel Type Fire Hydrants: Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, shall have 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Inlet shall have mechanical-joint or push-on joint end; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap

nuts, and threads on hose and pumper connections shall be as specified in AWWA C502. Hydrants indicated as "traffic type," shall have frangible sections as mentioned in AWWA C502. The traffic type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and upper and lower sections of hydrant stem and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall operate properly under normal conditions.

2.1.2.3 Valve Boxes

Provide a valve box for each gate valve. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Cast-iron boxes shall have a minimum cover and wall thickness of 3/16 inch. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.4 Tracer Wire for Nonmetallic Piping

Provide as specified in Section 31 00 00, EARTHWORK.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation (NSF) for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer.

a. Polyvinyl Chloride (PVC) Plastic Piping with Screw Joints: ASTM D 1785, Schedule 40; or ASTM D 2241, with SDR as necessary to provide 150 psi minimum pressure rating. Fittings, ASTM D 2466 or ASTM D 2467. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12; PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing, ASTM D 2564. Pipe couplings, when used shall be tested as required by ASTM D 2464.

b. Polyvinyl Chloride (PVC) Plastic Piping with Elastomeric-Gasket Joints:

   Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified.

c. Polyvinyl Chloride (PVC) Plastic Piping with Solvent Cement Joints:

   Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

2.2.2.2 Service Clamps

Service clamps used for repairing damaged cast-iron, steel, PVC or asbestos-cement pipe shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.2.2.3 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

2.2.2.4 Gate Valves Smaller than 3 Inch in Size

Gate valves smaller than 3 inch size MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.

2.2.2.5 Curb Boxes

Provide a curb box for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

2.2.2.6 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.2.2.7 Meters

Contractor shall supply and install in accordance with the Brunswick-Glynn Joint Water and Sewer Commission.

2.2.2.8 Meter Boxes

Contractor shall supply and install in accordance with the Brunswick-Glynn Joint Water and Sewer Commission.

2.2.2.9 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sewer line. Do not lay water lines in the same trench with electric wiring.

Where water piping is required to be installed within 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casting Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00.

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings.Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted.Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate

recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 feet.

3.1.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.1.5 Connections to Existing Water Lines

All connections to potable water lines 12 inches in diameter and smaller using corporation stops or tapping sleeves and tapping valves shall only be made by Brunswick-Glynn Joint Water and Sewer Commission approved Contractors. Coordinate this work, via the Contracting Officer's Technical Representative, with Brunswick-Glynn Joint Water and Sewer Commission Personnel. Provide corporation stops, tapping sleeves and tapping valves, and all other material, labor, and equipment necessary for the connection. Perform all earthwork and disinfection work at the connection prior to installation of the tapping machine by the Government. Perform the disinfection work in the presence of the Brunswick-Glynn Joint Water and Sewer Commission and FLETC personnel. Make connections to existing water lines in the presence of the Brunswick-Glynn Joint Water and Sewer Commission and FLETC personnel.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.

b. Allowable Deflection: The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size

and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94/C 94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.2 Installation of PVC Plastic Water Main Pipe

Installation of PVC Plastic Water Main Pipe and Associated Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines"; with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

b. Offset: Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer's Technical Representative, but shall not exceed 5 degrees.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of UBPPA UNI-B-3 for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94/C 94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts

sand, and 5 parts gravel, having the same minimum compressive strength.

d. Fittings: Install in accordance with AWWA C605.

3.1.2.3 Installation of Valves and Hydrants

a. Installation of Valves: Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, contact the Contracting Officer's Technical Representative for further instructions.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the point indicated; such water service lines shall be closed with plugs or caps.

3.1.4 Special Requirements for Installation of Water Service Piping

3.1.4.1 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

b. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4.2 Location of Meters

Meters and meter boxes shall be installed at the locations shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

3.1.5 Disinfection

Prior to disinfection, obtain Contracting Officer's Technical Representative approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer's Technical Representative approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer's Technical Representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water mains in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test PVC plastic water mains in accordance with the requirements of UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in UBPPA UNI-B-3, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of

the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 33 30 00

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASTM INTERNATIONAL (ASTM)

ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 270	(2007) Standard Specification for Mortar for Unit Masonry
ASTM C 443	(2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 923	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM C 969	(2002) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 972	(2000; R 2006) Compression-Recovery of Tape Sealant
ASTM C 990	(2006) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM D 1784	(2006a) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	(2005) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(2006) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a; R 2003e1) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 4101	(2007) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D 412	(2006a) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 624	(2000e1) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(Basic) Frames.Covers, Gratings, Steps, Sump and Catch Basin, Manhole

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27 Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6 (1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide lateral of polyvinyl chloride (PVC) plastic pipe. Provide building connections polyvinyl chloride (PVC) plastic pipe. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

1.2.2 Sanitary Sewer Pressure Lines

Provide pressure lines of polyvinyl chloride (PVC) plastic pressure pipe.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contracting Officer's Technical Representative. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer's Technical Representative. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipeline materials;

Submit manufacturer's standard drawings or catalog cuts.

SD-06 Test Reports

Reports;

Test and inspection reports, as specified.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

2.1.2.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.

(1) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478 base and first riser shall be monolithic.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923 or ASTM C 990.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Proplene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and values are listed in the following tables:

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic

Tensile, psi	ASTM D 412	1840	2195	-
Elogation percent	ASTM D 412	553	295	350
Tear Resistance, ppi	ASTM D 624 (Die B)	280	160	-
Rebound, percent, 5 minutes	ASTM C 972 (mod.)	-	-	11
Rebound, percent, 2 hours	ASTM C 972	-	-	12

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be as indicated:

Frames and covers shall be cast iron or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 Manhole Steps

Zinc-coated steel as indicated conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less 4 feet deep.

2.4 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 31 00 00 EARTHWORK.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 2 feet below bottom of water line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on

each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

a. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer's Technical Representative before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.2.2 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Pipe Less Than 4 Inch Diameter:

1 Solvent-weld joints shall comply with the manufacturer's instructions.

b. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94/C 94M having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Manhole Construction

Use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. At the existing sewer manhole, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.5.2 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles.

Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.6 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer's Technical Representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in

accordance with ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969.

b. Low-pressure air tests: Perform tests as follows:

1 PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Test PVC plastic pressure lines in accordance with the requirements of AWWA C605 for pressure and leakage tests, using the allowable leakage given therein.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 48/A 48M	(2003) Standard Specification for Gray Iron Castings
ASTM A 536	(1984; R 2004) Standard Specification for Ductile Iron Castings
ASTM B 26/B 26M	(2005) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C 231	(2004) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(2007a) Standard Specification for Mortar for Unit Masonry
ASTM C 443	(2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 76	(2007) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 923	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using

	Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 1751	(2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 6938	(2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipeline materials;

Submit manufacturer's standard drawings or catalog cuts.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76, Class III.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 3500 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.2.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.2.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure.

2.2.4 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48/A 48M, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26/B 26M, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3 MANHOLE STEPS

Zinc-coated steel as indicated conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or

minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less 4 feet deep.

2.4 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C 923.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PIPELINE MATERIALS

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5
Concrete-Lined Corrugated Steel	3
Ductile Iron Culvert	3
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be thoroughly cleaned with a wet brush and the lower portion of the bell filled with mortar as required to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in lengths that extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 8 inches apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

b. Grout: Grout shall be poured between band and pipe from the high side of band only, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be forced out by pouring, and removed.

c. Remainder of Joint: The remaining unfilled upper portion of the joint shall be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete or precast reinforced concrete complete with frames and covers or gratings; and with fixed steps where indicated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe.The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers.This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract

will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 6 inches.

3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.6.5 Determination of Density

Testing is the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained.Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 6938. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 6938 results in a wet unit weight of soil and ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.7 FIELD PAINTING

After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint Do not paint surfaces subject to abrasion.

-- End of Section --

SECTION 33 71 02.00 20

UNDERGROUND ELECTRICAL DISTRIBUTION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318M	(2005) Metric Building Code Requirements for Structural Concrete and Commentary
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005) Standard Specifications for Highway Bridges
AASHTO M 198	(2005) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM INTERNATIONAL (ASTM)

ASTM B 1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B 3	(2001; R 2007) Standard Specification for Soft or Annealed Copper Wire
ASTM B 8	(2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections

ASTM C 857	(2007) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM F 512	(2006) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; Errata 2007) National Electrical Safety Code
IEEE Std 100	(2000) The Authoritave Dictionary of IEEE Standards Terms

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2003) Acceptance Testing Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C119.1	(2006) Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA RN 1	(2005) Standard for Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
NEMA TC 6 & 8	(2003) Standard for Polyvinyl Chloride PVC Plastic Utilities Duct for Underground Installations
NEMA TC 9	(2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007) National Electrical Code - 2008 Edition

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758-A	(2004) Customer-Owned Outside Plant Telecommunications Cabling Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2006; Rev thru Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 44	(2005; Rev thru Nov 2005) Thermoset-Insulated Wires and Cables
UL 467	(2007) Standard for Grounding and Bonding Equipment
UL 486A-486B	(2003; Rev thru Aug 2006) Standard for Wire Connectors
UL 510	(2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(2004; Rev thru Aug 2007) Standard for Metallic Outlet Boxes
UL 514B	(2004; Rev thru Aug 2007) Standard for Conduit, Tubing and Cable Fittings
UL 6	(2007) Standard for Electrical Rigid Metal Conduit-Steel
UL 651	(2005; Rev thru May 2007) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 83	(2003; Rev thru Apr 2006) Standard for Thermoplastic-Insulated Wires and Cables
UL 854	(2004; Rev thru Oct 2007) Service-Entrance Cables

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Precast concrete structures;

Composite/fiberglass handholes;

1.4 NOT USED

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi.

2.1.2 Intermediate Metal Conduit

UL 1242.

2.1.2.1 Intermediate Metal Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi.

2.1.3 Plastic Conduit for Direct Burial

UL 651, Schedule 40 or Schedule 80 NEMA TC 2, EPC-40-PVC or EPC-80-PVC.

2.1.4 Plastic Duct for Concrete Encasement

NEMA TC 6 & 8 and ASTM F 512.

2.1.5 Innerduct

Provide corrugated or solid wall polyethylene (PE) or PVC innerducts with pullwire. Size as indicated.

2.1.6 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials. Inflatable bladders may be used as an option.

2.1.7 Fittings

2.1.7.1 Metal Fittings

UL 514B.

2.1.7.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.7.3 PVC Duct Fittings

NEMA TC 9.

2.1.7.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit shall be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and shall conform to UL 514A.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors shall be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site shall not be accepted. Service entrance conductors shall conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper. As an exception, do not substitute aluminum for copper if the equivalent aluminum conductor size would exceed 500 kcmil.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, shall be 600-volt, Type THWN/THHN conforming to UL 83 conforming to UL 44. Copper conductors shall be annealed copper complying with ASTM B 3 and ASTM B 8.

2.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.2.4 In Duct

Cables shall be single-conductor cable.

2.2.5 Cable Marking

Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Each cable shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations shall be properly identified. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. On three-phase, four-wire delta system, high leg shall be orange, as required by NFPA 70.

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Shall provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

b. For use with aluminum conductors: UL 486A-486B. For connecting aluminum to copper, connectors shall be the circumferentially compressed, metallurgically bonded type.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply NEMA C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as covering or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling in accordance with Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).

2.6 TAPE

2.6.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.6.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

2.7 PULL ROPE

Shall be plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.8 GROUNDING AND BONDING

2.8.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.8.2 Grounding Conductors

Stranded-bare copper conductors shall conform to ASTM B 8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors shall conform to ASTM B 1 for sizes No. 8 and smaller. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Aluminum is not acceptable.

2.9 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.10 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C 857 andASTM C 478. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

2.10.1 Precast Concrete Structures, Risers and Tops

In lieu of cast-in-place, Contractors, at their option, may provide precast concrete underground structures subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.10.1.1 General

Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures

shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.10.1.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads shall include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads shall consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load shall be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads shall include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, shall be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component shall be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

h. Design shall also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.10.1.3 Construction

Structure top, bottom, and wall shall be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment.

However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.10.1.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M 198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.10.2 Handhole Frames and Covers

Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled-steel floor plate having an approved antislip surface. Hinges shall be of stainless steel with bronze hinge pin, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and shall be for full surface application by fillet welding. Hinges shall have nonremovable pins and five knuckles. The surfaces of plates under hinges shall be true after the removal of raised antislip surface, by grinding or other approved method.

2.10.3 Composite/Fiberglass Handholes and Covers

Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758-A and RUS Bull 1751F-644.

3.2 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors shall be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit shall be PVC, Type EPC-40 from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

3.3 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.3.1 Requirements

Depths to top of the conduit shall be in accordance with NFPA 70. Run conduit in straight lines except where a change of direction is necessary. Numbers and sizes of ducts shall be as indicated. Ducts shall have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 3 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in structures.

3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.3.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.3.4 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be PVC coated and shall extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.3.5 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 1/2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.3.6 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.3.7 Conduit and Duct Without Concrete Encasement

Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in3 to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.3.7.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks.

3.3.8 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 1/2 inches, except separate light and power conduits from control, signal, and telecommunications conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring shall be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.3.8.1 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut

steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.3.8.2 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.3.8.3 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

3.4 CONDUCTORS INSTALLED IN PARALLEL

Conductors shall be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.5 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set.

3.6 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 23 00.00 20 EXCAVATION AND FILL.

3.6.1 Reconditioning of Surfaces

3.6.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.6.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.7 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.7.1 Concrete Slabs for Equipment

Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade shall have 1/2 inch chamfer.Slab shall be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.7.2 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.8 FIELD QUALITY CONTROL

3.8.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.8.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

DEPARTMENT OF HOMELAND SECURITY

NON-DISCLOSURE AGREEMENT

The person listed below is an individual official, employee, consultant, or subcontractor of or to the Authorized Entity listed above, intending to be legally bound, hereby consent to the terms in this Agreement in consideration of my being granted conditional access to certain information, specified below, that is owned by, produced by, or in the possession of the United States Government.

Full Name
Authorized Entity

Signer will acknowledge the category or categories of information that he or she may have access to, and the signer's willingness to comply with the standards for protection by placing his or her initials in front of the applicable category or categories.

PROTECTED CRITICAL INFRASTRUCTURE INFORMATION (PCII)	
Initials	I attest that I am familiar with, and I will comply with all requirements of the PCII program set out in the Critical Infrastructure Information Act of 2002 (CII Act) (Title II, Subtitle B, of the Homeland Security Act of 2002, Public Law 107-296, 196 Stat. 2135, 6 USC 101 et seq.), as amended, the implementing regulations thereto (6 CFR Part 29), as amended, and the applicable PCII Procedures Manual, as amended, and with any such requirements that may be officially communicated to me by the PCII Program Manager or the PCII Program Manager's designee.

SENSITIVE SECURITY INFORMATION (SSI)	
Initials	I attest that I am familiar with, and I will comply with the standards for access, dissemination, handling, and safeguarding of SSI information as cited in this Agreement and in accordance with 49 CFR Part 1520, "Protection of Sensitive Security Information," "Policies and Procedures for Safeguarding and Control of SSI," as amended, and any supplementary guidance issued by an authorized official of the Department of Homeland Security.

OTHER SENSITIVE BUT UNCLASSIFIED (SBU)	
Initials	As used in this Agreement, sensitive but unclassified information is an over-arching term that covers any information, not otherwise indicated above, which the loss of, misuse of, or unauthorized access to or modification of could adversely affect the national interest or the conduct of Federal programs, or the privacy to which individuals are entitled under Section 552a of Title 5, as amended, but which has not been specifically authorized under criteria established by an Executive Order or an Act of Congress to be kept secret in the interest of national defense or foreign policy. This includes information categorized by DHS or other government agencies as: For Official Use Only (FOUO); Official Use Only (OUO); Sensitive Homeland Security Information (SHSI); Limited Official Use (LOU); Law Enforcement Sensitive (LES); Safeguarding Information (SGI); Unclassified Controlled Nuclear Information (UCNI); and any other identifier used by other government agencies to categorize information as sensitive but unclassified. I attest that I am familiar with, and I will comply with the standards for access, dissemination, handling, and safeguarding of the information to which I am granted access as cited in this Agreement and in accordance with the guidance provided to me relative to the specific category of information.

ACKNOWLEDGEMENT
1. I hereby acknowledge that I have received a security indoctrination concerning the nature and protection of information to which I have been provided conditional access, including the procedures to be followed in ascertaining whether other persons to whom I contemplate disclosing this information have been approved for access to it, and that I understand these procedures.

2. By being granted conditional access to the information indicated above, the United States Government has placed special confidence and trust in me and I am obligated to protect this information from unauthorized disclosure, in accordance with the terms of this Agreement and the laws, regulations, and directives applicable to the specific categories of information to which I am granted access.

3. I attest that I understand my responsibilities and that I am familiar with and will comply with the standards for protecting such information that I may have access to in accordance with the terms of this Agreement and the laws, regulations, and/or directives applicable to the specific categories of information to which I am granted access. I understand that the United States Government may conduct inspections, at any time or place, for the purpose of ensuring compliance with the conditions for access, dissemination, handling and safeguarding information under this Agreement.

4. I will not disclose or release any information provided to me pursuant to this Agreement without proper authority or authorization. Should situations arise that warrant the disclosure or release of such information I will do so only under approved circumstances and in accordance with the laws, regulations, or directives applicable to the specific categories of information. I will honor and comply with any and all dissemination restrictions cited or verbally relayed to me by the proper authority.

    (a) For PCII - (1) Upon the completion of my engagement as an employee, consultant, or subcontractor under the contract, or the completion of my work on the PCII Program, whichever occurs first, I will surrender promptly to the PCII Program Manager or his designee, or to the appropriate PCII officer, PCII of any type whatsoever that is in my possession.

5. (2) If the Authorized Entity is a United States Government contractor performing services in support of the PCII Program, I will not request, obtain, maintain, or use PCII unless the PCII Program Manager or Program Manager's designee has first made in writing, with respect to the contractor, the certification as provided for in Section 29.8(c) of the implementing regulations to the CII Act, as amended.

6. (b) For SSI and SBU - I hereby agree that material which I have in my possession and containing information covered by this Agreement, will be handled and safeguarded in a manner that affords sufficient protection to prevent the unauthorized disclosure of or inadvertent access to such information, consistent with the laws, regulations, or directives applicable to the specific categories of information. I agree that I shall return all information to which I have had access or which is in my possession 1) upon demand by an authorized individual; and/or 2) upon the conclusion of my duties, association, or support to DHS; and/or 3) upon the determination that my official duties do not require further access to such information.

7. I hereby agree that I will not alter or remove markings, which indicate a category of information or require specific handling instructions, from any material I may come in contact with, in the case of SSI or SBU, unless such alteration or removal is consistent with the requirements set forth in the laws, regulations, or directives applicable to the specific category of information or, in the case of PCII, unless such alteration or removal is authorized by the PCII Program Manager or the PCII Program Manager's designee. I agree that if I use information from a sensitive document or other medium, I will carry forward any markings or other required restrictions to derivative products and will protect them in the same matter as the original.

8. I hereby agree that I shall promptly report to the appropriate official, in accordance with the guidance issued for the applicable category of information, any loss, theft, misuse, misplacement, unauthorized disclosure, or other security violation, I have knowledge of and whether or not I am personally involved. I also understand that my anonymity will be kept to the extent possible when reporting security violations.

9. If I violate the terms and conditions of this Agreement, such violation may result in the cancellation of my conditional access to the information covered by this Agreement. This may serve as a basis for denying me conditional access to other types of information, to include classified national security information.

    (a) With respect to SSI and SBU, I hereby assign to the United States Government all royalties, remunerations, and emoluments that have resulted, will result, or may result from any disclosure, publication, or revelation of the information not consistent with the terms of this Agreement.

    (b) With respect to PCII I hereby assign to the entity owning the PCII and the United States Government, all royalties, remunerations, and emoluments that have resulted, will result, or may result from any disclosure, publication, or revelation of PCII not consistent with the terms of this Agreement.

10. This Agreement is made and intended for the benefit of the United States Government and may be enforced by the United States Government or the Authorized Entity. By granting me conditional access to information in this context, the United States Government and, with respect to PCII, the Authorized Entity, may seek any remedy available to it to enforce this Agreement including, but not limited to, application for a court order prohibiting disclosure of information in breach of this Agreement. I understand that if I violate the terms and conditions of this Agreement, I could be subjected to administrative, disciplinary, civil, or criminal action, as appropriate, under the laws, regulations, or directives applicable to the category of information involved and neither the United States Government nor the Authorized Entity have waived any statutory or common law evidentiary privileges or protections that they may assert in any administrative or court proceeding to protect any sensitive information to which I have been given conditional access under the terms of this Agreement.
11. Unless and until I am released in writing by an authorized representative of the Department of Homeland Security (if permissible for the particular category of information), I understand that all conditions and obligations imposed upon me by this Agreement apply during the time that I am granted conditional access, and at all times thereafter.
12. Each provision of this Agreement is severable. If a court should find any provision of this Agreement to be unenforceable, all other provisions shall remain in full force and effect.
13. My execution of this Agreement shall not nullify or affect in any manner any other secrecy or non-disclosure Agreement which I have executed or may execute with the United States Government or any of its departments or agencies.
14. These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive Order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General or the Office of Special Counsel of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive Orders and statutory provisions are incorporated into this agreement and are controlling.
15. Signing this Agreement does not bar disclosures to Congress, the Special Counsel, the Inspector General of any agency, or any other agency component responsible for internal investigation or review of any information that relates to any violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or any other whistleblower protection. In addition, signing this agreement does not bar disclosure to an authorized official of an executive agency or the Department of Justice that are essential to reporting a substantial violation of law.
16. I represent and warrant that I have the authority to enter into this Agreement.
17. I have read this Non-Disclosure Agreement carefully. The briefing officer (e.g., Special Security Officer) has answered any questions that I had. I acknowledge that the briefing officer has made available to me any laws, regulations, or directives referenced in this document so that I may read them at this time, if I so choose. By applying my digital signature below, the briefing officer accepts that the signature is valid and meets the terms of non-repudiation.

I understand and agree to the following terms and conditions of my access to the information indicated above.

Full Name			
Government/Department/Agency/Business Address			
City	State	Zip Code	Phone
I make this Agreement in good faith, without mental reservation or purpose of evasion.			
Signature			Date

PRIVACY ACT STATEMENT

Authority: Homeland Security Act of 2002; and DHS Management Directive 11042.1, "SAFEGUARDING SENSITIVE BUT UNCLASSIFIED (FOR OFFICIAL USE ONLY) INFORMATION".

Principle Purpose: To execute an agreement between DHS and contractors (or consultants) working for, or on behalf of DHS, to protect DHS Sensitive but Unclassified Information from unauthorized disclosure.

Routine Use(s): The information collected on this form may be disclosed as generally permitted under 5 U.S.C. §552a (b) of the Privacy Act of 1974, as amended. This includes using the information as necessary and authorized by the routine uses published in "DHS/ALL-023 Personnel Security Management System of Records".

Disclosure: Providing this information is voluntary; however, failure to provide this information may prevent the individual from being granted access to DHS Sensitive but Unclassified Information.

U.S. Department of Labor
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. Dec. 2008

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Expires: 07/31/2024

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐	ADDRESS	
PAYROLL NO.	FOR WEEK ENDING	PROJECT AND LOCATION / PROJECT OR CONTRACT NO.

(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE — HOURS WORKED EACH DAY	(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS: FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
			O											
			S											
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that is will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE.

U.S. Department of Labor
Wage and Hour Division

Davis-Bacon and Related Acts Weekly Certified Payroll Form

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Unless otherwise noted, the information requested is specific to the named project below.

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. January 2025
OMB No.: 1235-0008
Expires: 01/31/2028

☐ SUBMISSION OF FINAL DBRA CERTIFIED PAYROLL FORM ☐ PRIME CONTRACTOR ☐ SUBCONTRACTOR

PROJECT NAME	PROJECT NO. or CONTRACT NO.	CERTIFIED PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME
PROJECT LOCATION	**WAGE DETERMINATION NO.**	**WEEK ENDING DATE**	**PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS ADDRESS**

(1A)	(1B)	(1C)	(1D)	(1E)	(2)	(3)		(4)		(5)	(6A)	(6B)	(6C)	(7A)	(7B)	(8)				(9)
WORKER ENTRY NO.	WORKER LAST NAME	WORKER FIRST NAME	WORKER MIDDLE INITIAL	WORKER IDENTIFYING NO.	(J) JOURNEYWORKER (RA) REGISTERD APPRENTICE	LABOR CLASSIFICATION		ST = STRAIGHT TIME OT = OVERTIME	(TOP) DAYS OF WORK WEEK (BOTTOM) DATES HOURS WORKED EACH DAY	TOTAL HOURS WORKED FOR WEEK	HOURLY WAGE RATE PAID FOR ST AND OT	TOTAL FRINGE BENEFIT CREDIT	PAYMENT IN LIEU OF FRINGE BENEFITS	GROSS AMT EARNED	GROSS AMT EARNED FOR **ALL WORK**	DEDUCTIONS FOR **ALL WORK**				NET PAY TO WORKER FOR **ALL WORK**
																TAX WITH-HOLDINGS	FICA	OTHER (MUST SPECIFY, SEE INSTRUCTIONS)	TOTAL DEDUCTIONS	
								ST												
								OT												
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While use of Form WH-347 itself is optional, covered contractors and subcontractors performing work on Federal or federally assisted construction contracts are required by the DBRA regulations and the contract clauses to submit payroll information on a weekly basis. The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federal or federally financed construction contracts to, on a weekly basis, "furnish a statement on the wages paid each employee during the prior week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors and subcontractors to submit weekly certified payrolls to the appropriate Federal agency if the agency is a party to the contract (or, if the agency is not such a party, to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the Federal agency). Each certified payroll must be accompanied by a signed "Statement of Compliance" (e.g., page 2 of the WH-347 or another document with identical wording) indicating that the certified payrolls are accurate and complete, and that each laborer or mechanic has been paid not less than the required Davis-Bacon prevailing wage rate(s) (including any fringe benefits) for the work performed. DOL and contracting agencies receiving this information review the information to determine whether workers have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

PROJECT NAME	PROJECT NO. or CONTRACT NO.	PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME

PROJECT LOCATION	WEEK ENDING DATE	CERTIFYING OFFICIAL's NAME AND TITLE

I paid or supervised the payment of the laborers or mechanics working on the above project during the stated time period. I certify the following:

☐ The payroll information submitted with this statement is correct and complete for the above project during the above period, and the wage and fringe benefit rates paid to the workers, including credit taken for the reasonably anticipated costs of a bona fide fringe benefit plan, fund or program, are not less than the applicable wage and fringe benefits rates for the classification(s) of work actually performed, as specified in the wage determination(s) incorporated into the contract.

☐ All regular payrolls and all other basic records that the contractor is required to maintain for this payroll period are complete and accurate and will be made available upon request from the agency or the Department of Labor.

☐ The classifications reported for each laborer or mechanic are the classification(s) of work that each worker actually performed.

☐ Any workers paid as apprentices during the above period are duly registered in a bona fide apprenticeship program registered with the Office of Apprenticeship, Employment and Training Administration, United States Department of Labor ("OA"), or a State Apprenticeship Agency ("SAA") recognized by Department of Labor. I have verified the registered apprenticeship program information provided below as accurate and applicable to any apprentices identified on page 1 of this form.

APPRENTICESHIP PROGRAM NAME	REGISTERED		NAME OF LABOR CLASSIFICATION
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	

☐ Fringe benefits have been paid in cash and/or to bona fide fringe benefit plans, funds, or programs. Where the contractor is claiming an hourly credit for their contributions to or reasonably anticipated costs of a bona fide fringe benefit plan, fund, or program, provide plan information and the hourly credit claimed for each worker listed on the previous page of this form.

HOURLY CREDIT FOR FRINGE BENEFITS

If an amount is listed in (6B) on the first page of this certified payroll form, enter the hourly credit claimed under each plan name, type and number for each worker and check whether the plan is funded or unfunded.

NAME OF WORKER	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	TOTAL HOURLY CREDIT
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hrly Credit $	$

☐ All workers on the project have been paid the full weekly wages earned, and no rebates or deductions have been or will be made either directly or indirectly, other than permissible deductions as defined in 29 CFR part 3.

ADDITIONAL REMARKS

SIGNATURE OF CERTIFYING OFFICIAL	DATE	TELEPHONE NUMBER	EMAIL ADDRESS
		(___) ___-____	

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION (SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE), AS WELL AS DEBARMENT FROM FUTURE FEDERAL AND FEDERALLY-ASSISTED CONTRACTS. INFORMATION REPORTED IN CERTIFIED PAYROLLS MAY BE SUBJECT TO DISCLOSURE IN RESPONSE TO A FREEDOM OF INFORMATION ACT REQUEST.

Badge Application Addendum for Non-U.S. Citizens, Lawful Permanent Residents and Naturalized U.S. Citizens

Information provided by those completing this form may be used to conduct background checks on the applicant in accordance with FLETC Directive 71-01, Access Control. Privacy Act Statement: This information is provided in accordance with the Privacy Act of 1974 (5 USC 552a). Authority for this information is 5 USC 301, 5 USC 4101 et seq., Executive Order No. 11348, and Department of Homeland Security Delegation 7050. Disclosure of this information is voluntary. Failure to provide requested information may result in denial of access to the FLETC property.

TO BE COMPLETED BY APPLICANT

1. Applicants Full Name: _____

(Last, First, Middle)

Aliases Used (nicknames, maiden names, etc): _____

2.Country of Citizenship: _____

(List more than one if applicable)

Place of Birth: _____

(City, State and/or Country)

3. Status:

- ☐ US Citizen (Naturalized)
- ☐ Permanent Resident — Provide A# _____
- ☐ Non-Immigrant Status — Provide I-94# _____
- ☐ Employment Authorization Card Holder — Provide A# _____
- ☐ Border Crossing Card Holder — Provide Card# _____
- ☐ Other Status — Indicate: _____

4. Non-US Citizens must provide copies of documentation related to their status in the US, including employment authorization, passport and visa.

ATTACHED:

☐ Copy of Passport

if no Passport or Visa exists, insert "None" in provided space

Country of Issue: _____ Passport Number: _____ Date: _____

☐ Copy of Visa

Visa Number: _____ Visa Type: _____ Date: _____

☐ Copy of Naturalization Certificate

☐ Copy of Permanent Resident/Alien Card

☐ Copy of Employment Authorization Card

☐ Border Crossing Card

☐ Other document verifying non-immigrant status

5. I certify the information provided is true and accurate to the best of my knowledge. I acknowledge that knowingly or willingly falsifying information in the document is a violation of 18 US Code Section 1001.

Applicant's Signature: _____ Date: _____

Badge Application Addendum for Non-U.S. Citizens, Lawful Permanent Residents and Naturalized U.S. Citizens

Information provided by those completing this form may be used to conduct background checks on the applicant in accordance with FLETC Directive 71-01, Access Control. Privacy Act Statement: This information is provided in accordance with the Privacy Act of 1974 (5 USC 552a). Authority for this information is 5 USC 301, 5 USC 4101 et seq., Executive Order No. 11348, and Department of Homeland Security Delegation 7050. Disclosure of this information is voluntary. Failure to provide requested information may result in denial of access to the FLETC property.

TO BE COMPLETED BY APPLICANT

1. Applicants Full Name: _____

(Last, First, Middle)

Aliases Used (nicknames, maiden names, etc): _____

2.Country of Citizenship: _____

(List more than one if applicable)

Place of Birth: _____

(City, State and/or Country)

3. Status:

- ☐ US Citizen (Naturalized)
- ☐ Permanent Resident — Provide A# _____
- ☐ Non-Immigrant Status — Provide I-94# _____
- ☐ Employment Authorization Card Holder — Provide A# _____
- ☐ Border Crossing Card Holder — Provide Card# _____
- ☐ Other Status — Indicate: _____

4. Non-US Citizens must provide copies of documentation related to their status in the US, including employment authorization, passport and visa.

ATTACHED:

☐ Copy of Passport

if no Passport or Visa exists, insert "None" in provided space

Country of Issue: _____ Passport Number: _____ Date: _____

☐ Copy of Visa

Visa Number: _____ Visa Type: _____ Date: _____

☐ Copy of Naturalization Certificate

☐ Copy of Permanent Resident/Alien Card

☐ Copy of Employment Authorization Card

☐ Border Crossing Card

☐ Other document verifying non-immigrant status

5. I certify the information provided is true and accurate to the best of my knowledge. I acknowledge that knowingly or willingly falsifying information in the document is a violation of 18 US Code Section 1001.

Applicant's Signature: _____ Date: _____

STATEMENT OF WORK

BG0166 FAD OD Range cart storage facility

1/22/26

Section Index

SECTION 1

1.1 REFERENCES
1.2 DEFINITIONS
1.3 WORK COVERED BY CONTRACT DOCUMENTS
1.3.1 PROJECT DESCRIPTION
1.4 SUBMITTALS
1.5 LOCATION
1.6 CONTRACT DRAWINGS
1.7 BADGING
1.8 WORK SCHEDULING
1.9 COORDINATION, QUALITY CONTROL AND ASSURANCE
1.10 PROJECT ENVIRONMENTAL GOALS
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SECTION 2

PRODUCTS

SECTION 3

3.1 PERIOD OF PERFORMANCE
3.2 INSTALLATION
3.3 ATTACHMENTS

SECTION 1

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 2114 (2008) Standard Terminology for Sustainability Relative to the Performance of Buildings

1.2 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E 2114, and as specified.

a) "Environmentally preferable products" have a lesser or reduced effect on the environment in comparison to conventional products and services. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

b.) "Indoor environmental quality" is the physical characteristics of the building interior that impact occupants, including air quality, illumination, acoustics, occupant control, thermal comfort, daylighting, and views.

c) "Operational performance" refers to the functional behavior of the building as a whole or of its components.

d.) "Sustainability" is the balance of environmental, economic, and societal considerations.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

Perform work on IAW contract: Drawings, specifications, reference documents, and contract provisions. Provide all labor, material, equipment, and supervision required to accomplish the following work:

1.3.1 Project Description

The contractor will furnish all labor, materials, equipment, and supervision necessary to accomplish the work detailed herein. The contractor will also verify all quantities, dimensions, and site conditions in the field. The contractor will supply all supplemental and related miscellaneous work to comply with the scope of work as indicated in the Specifications, Statement of Work, and/or Contract.

*NOTE: This project will comply with the Buy American Act whenever possible, ensuring the use of domestically produced materials and products in accordance with applicable regulations.

This project is for the design and construction of a range cart storage facility. The facility will provide secure and weather-resistant storage for Firearms Division range carts and related equipment. Utilizing a design-build approach, the project will integrate the design and construction phases to enhance efficiency, minimize costs, and ensure high-quality outcomes. The contractor will handle all parts of the project, including site evaluation, design, permitting, construction, and final delivery. The facility will meet all required codes, standards, and regulations while supporting operational needs and ensuring durability.

1.3.1a Site Preparation

Site preparation for the range cart storage facility will include all necessary activities to ensure the area is ready for construction. This will involve clearing and grading the site to create a level and stable foundation, removing any debris, vegetation, or obstacles. Soil testing and compaction will be performed as needed to ensure the ground can support the structure. Drainage systems will be installed as needed to prevent water accumulation and protect the facility from potential flooding. Utility connections, such as water, electricity, and other services, will be coordinated and prepared for integration into the building. All site preparation work will comply with applicable codes, regulations, and environmental requirements to ensure safety and long-term stability.

1.3.1a Demolition

Demolition and removal work for the installation of the range cart storage facility will include the removal of two existing light poles, earth, asphalt, trees, and any other items necessary to clear the site for construction. This process will involve safely disconnecting and removing the light poles, excavating and disposing of earth and asphalt materials, and clearing trees and vegetation while adhering to environmental regulations. Any additional items or structures that obstruct the installation of the building will also be removed. All debris and materials will be properly disposed of or recycled in compliance with local, state, and federal requirements. The demolition work will be conducted in a manner that minimizes disruption to surrounding areas and ensures the site is fully prepared for the next phase of construction.

1.3.1b Construction

Note: Drawings will be provided as separate attachments to be used “for reference” for the following:

a) The project involves the installation of an approximately 80' x 160' steel metal building with approximately 12’ eave height on a concrete slab, which will include electrical, water, and sewer connections to support operational needs. The building will feature gutters along both long sides with downspouts for proper drainage and will be equipped with 4-inch-thick insulation to enhance energy efficiency and climate control. The color of the building will be determined from manufacturers standard options.

   The building will be designed to support the load of ceiling-mounted fans, lighting, fire suppression systems, cart electrical retractable cord reels, and all other required equipment. The construction will include a minimum of 26-gauge roof and wall panels for durability. The building will meet wind speed requirements of at least 130 MPH, in accordance with the current local International Building Code (IBC). Concrete to be minimum 4000 PSI with fiber and #4 rebar on 12” centers or otherwise stated by the stamped engineered drawings.

b) The building will include two interior rooms to support specific operational functions. One room, approximately 12' x 12', will feature a secure, non-corrosive metal overhead coiling door with a FLETC approved locking mechanism, a sink for handwashing, and an eyewash/shower combination located outside the room for safety, along with a floor drain for proper water management. The second room will serve as an electrical room, equipped with a thermostat-controlled exhaust fan to regulate temperature and double doors on the exterior of the building for easy access.

c) The electrical system of the building will be designed to support the installation of electrical outlets throughout the building in compliance with code, large ceiling-hung fans, wall-mounted fans, overhead door operators, overhead lighting, spot heaters to maintain a

manageable temperature, and one 120-volt, 20-amp ceiling-mounted retractable cord reel for approximately 60 carts, plus an additional 2 for spares. The electrical design will also incorporate all other building systems and required components. The building's switchgear will be installed in the electrical room, which will feature double doors for easy access and maintenance.

d) Each long side of the building will include two 3/0 metal exterior doors with each having a half glass safety window and protected by exterior stainless steel non-corrosive removeable bollards and yellow sleeve covers for added safety and protection. Use FLETC approved locks and hardware. Doors are to have steel interior structure inside.

The two shorter ends of the building will serve as entrance and exit points, each featuring two metal overhead roll-up doors positioned approximately as shown in the attached drawing, allowing for a roadway for the carts. Additionally, each end will feature a standard 3/0 metal door steel interior structure with a half-glass safety window, FLETC approved hardware and locks, and protected by exterior stainless steel non-corrosive removeable bollards and yellow sleeve covers for added safety and protection. To ensure proper ventilation, a gable fan will be installed at each end of the building, sized to provide adequate airflow.

The overhead roll-up doors will be equipped with electric operators featuring chain assistance for ease of use and reliable operation. The basis of design for the roll-up doors is Overhead Door model 625 or an approved equal meeting all salient characteristics. The basis of design for the overhead door operator is Overhead Door model RHX or an approved equal meeting all salient characteristics. Six remote door operators will be provided, with each remote capable of operating all four roll-up doors` independently. Each roll up door will also have an interior mounted open-close-stop momentary switch for operation of the door. Each roll up door will incorporate a bottom mounted pressure edge for safety. All doors and operators will be programmed and thoroughly checked to ensure proper operation. This includes verifying functionality, remote compatibility, and compliance with project requirements to guarantee reliable and efficient performance.

Each end of the building with roll-up doors will be equipped with a minimum of one LED floodlight. The floodlights will provide adequate illumination for the entrance and exit areas to ensure safety during after-hours use. The lighting will be positioned to effectively cover the roadway and surrounding areas for clear visibility and safe operation.

The building will include eave vents and ridge cap vents to ensure proper airflow and ventilation. Both types of vents will be designed to allow easy closure when needed, providing flexibility to control airflow based on environmental conditions or operational requirements.

The area near the cart repair storage room will include a wall-mounted variable speed fan to ensure proper air circulation. Basis for design is Big Ass fans Aireye or other approved equal with salient characteristics. The fans shall be manufactured in the USA to meet project requirements and ensure compliance with applicable standards. This fan will enhance ventilation in the immediate area, supporting a comfortable and safe environment for operations and equipment maintenance.

The building will include a minimum of three large overhead variable speed fans strategically installed throughout the interior to ensure proper airflow for equipment cooling and ventilation. Basis for design is Big Ass Fans PowerFoil X4 or other approved equal with salient characteristics. The fans shall be manufactured in the USA to meet project requirements and ensure compliance with applicable standards. These fans will be designed to enhance air circulation, maintain a safe environment, and support the efficient operation of equipment within the building.

e) The building shall be equipped with a foam-type fire suppression system specifically designed to accommodate various battery chemistries. This system will provide effective fire protection tailored to the unique risks associated with battery storage and handling, ensuring safety and compliance with applicable fire codes and standards.

The building will be equipped with a heat detection system and a fire alarm panel designed to integrate seamlessly into FLETC's existing fire alarm system. This setup will ensure early detection of potential fire hazards and provide reliable communication with the broader safety infrastructure for prompt response and enhanced protection.

***NOTE:** Honeywell Notifier fire alarm panel and devices will be required for this project. The Contracting Officer (CO) will maintain possession of the brand name justification document.

1.4 SUBMITTALS

Submittals are required for all material and equipment items. They must be reviewed and approved prior to ordering materials and starting construction.

a) All products and/or materials shall conform to the requirements and related specifications of this Statement of Work and shall be first quality, complying with all standards and applicable building codes.

b) The Contractor shall provide submittals to the Contracting Officer Representative (COR). Submittals shall include, but not be limited to, material data sheets, drawings, manufacturer's installation details, AHA & CPL, fall protection plans, Hot Work permits, construction schedule and other documents as required.

***The PM or other government-approving official must verify that all materials comply with the SOW and approved submittals prior to installation and/or the start of construction. If the contractor fails to comply, the CO will be notified immediately that the contractor is not in compliance with the SOW or approved submittals**.

Government approval is required for all submittals, including:

a) Project schedule - Proposed construction dates

b) AHA and CPLs, Accident Prevention Plan, Health and Safety Plan

c) Quality Control plan, Environmental plan, and Work plan

d) Steel building stamped engineered drawings to include foundation

e) Electrical equipment: All wire/cable, breakers, switchgear and all other required electrical components

f) Exhaust fans including gable and electrical room

g) Overhead coil doors, operators, controls, and remotes

h) Coil grill door and hardware for the cart repair storage area

i) Stainless steel removeable bollards and plastic yellow covers

j) Exterior Doors and hardware

k) Commercial electrical cord reels

l) Sink and eyewash/shower combo

m) Floor drain

n) Sewer and drain piping

o) Large ceiling mounted fans and wall mounted fans

p) Foam fire suppression system and shop drawings

q) Heat detection and fire alarm system and shop drawings

r) All paint/coatings, chemicals, including non-corrosive spray

s) Certificates Of Insurance

t) Security Bonds

u) Submittal Register

v) Schedule Of Prices or Earned Value Report

1.5 LOCATION

The work shall be located at the FLETC, GLYNCO GA. Campus, building 252. The exact location will be shown by the Contracting Officer/Contracting Officer's Representative during the site visit.

1.6 CONTRACT DRAWINGS

The following drawings accompany this specification and are a part thereof.

See section 3.3 for attachments.

1.7 BADGING

a) All Government Contractors require badging to enter the FLETC.

b) All badging applications for Contractors and their Subs must be submitted to the Project Manager/Engineer at the time of the Pre-construction meeting if a Pre-construction meeting is required.

c) The Superintendent/QC will be required to keep an updated spreadsheet of all badges associated with this contract.

d) The Spreadsheet shall consist of the following: Company Name, Individual Name, Contract Number, and badge status (Picked up, processing, waiting on fingerprints, etc.). It shall be readily available for the Project Manager and brought to the progress meeting that will be scheduled every two weeks.

1.8 WORK RESCHEDULING

Normal duty hours for work shall be from 7:30 a.m. to 5:30 p.m., Monday through Friday. Requests for additional work shall require written approval from the Contracting Officer 7 days in advance of the proposed work period.

NOTE: Building(s) may be occupied during performance of work under this Contract. Before work starts, arrange with the Contracting Officer a sequence of procedures, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

a) Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work. Submit a written Transportation of Personnel, Materials, and Equipment Plan describing access procedures throughout the project duration.

b) If occupied, building 252 will remain in operation during the entire construction period. The Contractor must conduct his operations to cause the least possible interference with normal activity. Work must be coordinated with circulation patterns within the building. Circulation patterns cannot be closed off entirely.

c) Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing at least 15 calendar days before the desired date of interruption.

d) The work under this contract requires special attention to scheduling and conducting the work in connection with existing operations. Identify on the construction schedule each factor that constitutes a potential interruption to operations.

1.9 COORDINATION, QUALITY CONTROL, AND ASSURANCE

a) Coordinate construction schedule and all construction operations with the Contracting Officer Representative (COR).

b) The Superintendent / QC is responsible for ensuring that all work performed is in accordance with the terms of the Contract.

c) All work is to be inspected by the Government and accepted before the issuance of final payment.

d) The contractor shall verify all measurements, locations, and requirements of the job.

e) The contractor shall keep the construction area maintained throughout the project.

f) All deliveries SHALL be coordinated with the Government Project Manager/COR, all deliveries shall be delivered to the FLETC back gate off Vogel Rd.

g) If the information in the Contract conflicts with that in this Statement of Work, the Contract shall take precedence.

h) The Contractor shall preserve and restore the site ecosystem and biodiversity, avoid site degradation and erosion, and minimize offsite environmental impact.

1.10 PROJECT ENVIRONMENTAL GOALS

The contractor shall distribute copies of the Environmental Goals to each subcontractor and the Contracting Officer. The overall goal for design, construction, and operation is to produce a building that meets the functional program needs and incorporates the principles of sustainability. Specifically:

a) Preserve and restore the site ecosystem and biodiversity; avoid site degradation and erosion. Minimize off-site environmental impact.

b) Use the minimum amount of energy, water, and materials feasible to meet the design intent. Select energy and water-efficient equipment and strategies.

c) Use environmentally preferable products and decrease the toxicity level of materials used.

d) Use renewable energy and material resources.

e) Optimize operational performance (through commissioning efforts) to ensure energy-efficient equipment operates as intended. Consider the durability, maintainability, and flexibility of building systems.

f) Manage the construction site and storage materials to ensure no negative impact on the building's indoor environmental quality.

g) Reduce construction waste through reuse, recycling, and supplier take-back.

1.11 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

a) Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b) Repair or replace portions of existing work, which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.12 ON-SITE PERMITS

Notify the PM and the Contracting Officer at least 48 hours prior to starting excavation work. The contractor is responsible for marking and verifying all utilities. The Contractor shall verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed. Work shall be scheduled to hold outages to a minimum.

Requests for utility outages and connections shall be made by writing to the Contracting Officer and PM at least 2 calendar days in advance of the time required. Each request shall state the system involved, the area involved, the approximate duration of the outage, and the nature of the work involved.

1.13 UTILITY OUTAGE REQUESTS AND UTILITY CONNECTION REQUESTS

Notify the Contracting Officer at least 48 hours before starting the excavation work. The contractor is responsible for marking and verifying all utilities.

The Contractor shall verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified that needs removal. Requests for utility outages and connections need to be in writing to the Contracting Officer at least two days in advance of the time required. Each request shall state the system involved, the area involved, the approximate duration of the outage, and the nature of the work involved. Schedule work to hold outages to a minimum.

1.14 LOCATION OF UNDERGROUND FACILITIES

1.14.1 Notification Prior to Excavation

The contractor shall properly locate all underground utilities by contacting Georgia 811 and FLETC Facilities Management Divisions, Operations Branch (912-267-2413). All utility locates must be called at least one (1) week before beginning work. The 811 locate ticket number and the FLETC Operations Work Order number must be presented to the COR before work begins. Locates have an expiration date; if the locate expires before work has been completed, the contractor shall contact Georgia 811 for a new locate.

SECTION 2 PRODUCTS

Ensure that all products used in the project meet the specified requirements and are installed according to the manufacturer's guidelines and industry standards to ensure the longevity and performance of all installed products.

SECTION 3 EXECUTION

3.1 PERIOD OF PERFORMANCE

Period of performance not to exceed 180 calendar days in which to complete this project from Notice to Proceed (NTP). Notice to proceed shall be issued once all materials are on site and all badging has been approved.

3.2 INSTALLATION

a) All products and materials are installed and constructed using the manufacturer's published instructions, specifications, and industry standards.

b) No product and/or materials shall be installed without the Contractor first receiving written approval from the COR/Engineer regarding submittal items. Materials used on this project are to be submitted and approved/approved prior to use.

c) Acceptance of products/materials shall be accomplished by either furnishing testing results conducted during manufacturing, furnishing manufacturing certification followed by the results of random verification testing, or pre-approving and testing a product or its components prior to utilization.

d) The contractor shall verify all dimensions and conditions prior to beginning work or ordering materials. The contractor shall review site conditions with the Project Manager prior to ordering materials and starting work.

e) The Contractor shall properly locate all underground utilities by contacting Georgia 811 and FLETC Facilities Management Divisions, Operations Branch (912-267-2413). All utility locates must be called at least one (1) week before beginning work. The 811 locate ticket number and the FLETC Operations Work Order number must be presented to the COR before work begins. Locates have an expiration date; if the locate expires before work has been completed, the contractor shall contact Georgia 811 for a new locate.

f) No product and/or materials shall be backfilled without first being inspected by the COR. Any product and/or materials backfilled without first being inspected by the COR shall be excavated at the Contractor's expense to allow for inspection as required by this section of the Statement of Work.

g) Clean out of concrete trucks hauling cast-in-place concrete shall not occur on FLETC property.

h) All work shall be installed/constructed in accordance with specifications, manufacturer-published instructions, and industry standards.

i) All work shall be performed utilizing the latest codes for the work to be accomplished.

j) Material generated by excavation and demolition activity shall fully be recycled when possible, and quantities of all regular wastes and recyclables shall be documented in accordance with the requirements of Specification Section 01 57 19.00 20 entitled “Temporary Environmental Controls”. All waste material shall be disposed of off FLETC property, in accordance with applicable federal, state, and local regulations. The contractor is to provide COR with documentation of the weights of all materials (segregated by material types) recycled and disposed of.

k) *Note: FLETC maintains a sole-source contract with Certified Controls. The contractor must coordinate with Certified Controls to provide and install a proper control system.

3.3 ATTACHMENTS

Attachment “A” – Fire Suppression System design and commissioning

-See the following page-

"Attachment A"

1. Scope:
The contractor shall design, furnish, and install an automatic fire suppression system for the new building as part of this design/build project. The system shall comply with all applicable federal, state, and local fire codes, standards, and regulations, including but not limited to the National Fire Protection Association (NFPA) standards. The contractor shall engage a qualified Fire Protection Engineer (FPE) to evaluate the building's requirements and design a suppression system tailored to the specific application and use of the facility.

2. Requirements:

2.1 Fire Protection Engineer (FPE):
- The contractor shall retain a licensed and certified Fire Protection Engineer (FPE) to evaluate the building's fire protection needs.
- The FPE shall conduct a thorough assessment of the building design, intended use, occupancy type, fire hazards, and applicable codes and standards to determine the most appropriate fire suppression system.
- The FPE shall provide stamped and signed design drawings and calculations for the fire suppression system.

2.2 Design:
- The fire suppression system shall be designed to provide adequate protection for the building and its occupants based on the building's intended use and occupancy classification.
- The design shall comply with NFPA standards, including but not limited to NFPA 13 (Standard for the Installation of Sprinkler Systems), NFPA 14 (Standard for the Installation of Standpipe and Hose Systems), NFPA 20 (Standard for the Installation of Stationary Pumps for Fire Protection), and NFPA 72 (National Fire Alarm and Signaling Code), as applicable.
- The system design shall include all necessary components, such as sprinkler heads, pipes, valves, pumps, control panels, and alarms, to ensure full functionality and compliance.
- The FPE shall evaluate and recommend the type of suppression system most suitable for the building (e.g., wet pipe, dry pipe, pre-action, or other specialized systems).

2.3 Installation:
- The contractor shall furnish all materials, equipment, and labor necessary to install the fire suppression system in accordance with the approved design.
- Installation shall be performed by qualified personnel with experience in fire suppression systems.
- The contractor shall coordinate with other trades to ensure seamless integration of the fire suppression system with the building's construction and systems.

2.4 Testing and Commissioning:
- Upon completion of installation, the contractor shall perform all required testing and commissioning of the fire suppression system to ensure proper functionality and compliance with applicable standards.
- Testing shall include hydrostatic testing, flow testing, alarm testing, and any other required tests as specified by NFPA standards.

- The contractor shall provide documentation of all tests and certifications to the Contracting Officer or designated representative.

2.5 Documentation and Training:

- The contractor shall provide as-built drawings, system manuals, and maintenance instructions for the fire suppression system.
- The contractor shall conduct training for facility personnel on the operation and maintenance of the system.

3. Deliverables:

- Fire suppression system design drawings and calculations stamped by the FPE.
- Documentation of testing and commissioning results.
- As-built drawings and system manuals.
- Training for facility personnel.

4. Compliance: The fire suppression system shall comply with the following standards and regulations:

- NFPA standards (e.g., NFPA 13, NFPA 14, NFPA 20, NFPA 72, etc.).
- International Building Code (IBC).
- International Fire Code (IFC).
- Local and state fire codes and regulations.

5. Schedule:

The contractor shall ensure the fire suppression system design, installation, testing, and commissioning are completed in accordance with the overall project schedule.

6. Quality Assurance:

The contractor shall implement quality assurance measures to ensure the fire suppression system meets all design and performance requirements.

Federal Law Enforcement Training Centers

GLYNCO, GEORGIA

-End of Statement-

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SECTION 01 14 00

WORK RESTRICTIONS

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Not used

1.2 NOT USED

1.3 CONTRACTOR ACCESS AND USE OF PREMISES

1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. To minimize traffic congestion, delivery of materials shall be outside of peak traffic hours (6:30 to 8:00 a.m. and 3:30 to 5:00 p.m.) unless otherwise approved by the Contracting Officer. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.3.1.1 Subcontractors and Personnel Contacts

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.3.1.2 Identification Badges and Installation Access

Identification badges are required and will be furnished without charge. Application for and use of badges will be as directed by the Contracting Officer. Immediately report instances of lost or stolen badges to the Contracting Officer. See Section H regarding lost badges. All badges must be immediately returned to the point of issue upon badge expiration, contract completion, firing or removal of employee, or at the request of the approving authority.

1.3.1.3 Employee List

The Contractor shall provide to the Contracting officer, in writing, the names of two designated representatives authorized to request personnel and vehicle passes for employees and subcontractor's employees prior to commencement of work under this contract.

1.3.1.4 Personnel Entry Approval

Failure to obtain entry approval will not affect the task order price or time of completion.

1.3.1.5 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installations under the cognizance of FLETC except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.3.2 Working Hours

Normal working hours shall consist of an 8 hour period established by the Contractoing Officer, between 7:30 a.m. and 4:30 p.m., Monday through Friday, excluding Government holidays.

1.3.3 Work Outside Regular Hours

Work outside (Normal) working hours requires Contracting Officer approval. Make application 3 to 5 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.

1.3.4 Occupied and Existing Buildings

The Contractor will be working in existing occupied buildings.

The existing buildings and their contents shall be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the building during the construction period.

1.3.5 Utility Cutovers and Interruptions

a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."

b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and sprinkler shall be considered utility cutovers pursuant to the paragraph entitled "Work Outside Normal Hours." Such interruption shall be further limited to 8 hours. This time limit includes time for deactivation and reactivation.

d. Operation of Station Utilities: The Contractor shall not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

1.4 SECURITY REQUIREMENTS

1.4.1 Citizenship Requirements

Aliens are not allowed on the project site. Work under this contract is restricted to U.S. citizens.

1.4.2 Documents Acceptable for Proof of Citizenship

a. Birth registration card

b. Certificate of live birth, birth certificate

c. Certificate of registration

d. Delayed birth certificate

e. Hospital birth certificate

f. Military officer ID card

g. USA passport

1.4.3 Passes

Submit request for personnel and vehicle passes together. Include the Certificate of Insurance for Contractor and Subcontractor(s) and the Statement of Acknowledgement Form SF 1413 with the submittal. Passes will normally be issued within 21 days, see Section H.

1.4.3.1 Control

Maintain strict accountability over passes. Immediately report to the source of issue, passes missing or lost and the circumstances.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

Requirements of this Section apply to, and are component to, each section of the specifications.

The Government may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Contractor's Quality Control Manager (QCM) to check and approve all items prior to submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval will be identified by each task order and are to be scheduled and made prior to the acquisition of the material or equipment covered thereby.

Submittals will be received from the Contractor and returned to the Contractor in designated mail boxes located at the FMD Office Building 200.

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Certificates of insurance
Surety bonds
Qualifications, Certifications, Resumes, Letters of Commitment, and Appointment Letters for all Key Personnel: Quality Control Manager (QCM), Alternate Quality Control Manager, Project Manager(PM), Alternate Project Manager, Superintendent, and Alternate Superintendent.
List of proposed subcontractors and suppliers
Accident Prevention and Health and Safety Plans
Quality Control (QC) plan
Environmental Protection and Waste Management Plan
Indoor Air Quality Management Plan
Activity Hazard Analysis (AHA) (designated per Task Order)

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.1.2 Approving Authority

Project Manager/COR designated person authorized to approve submittal.

1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTALS

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

SD-01 Preconstruction Submittals

> The below listed Pre-Construction Submittals are critical, if the award constitutes pre-construction submittals to start work activities and are required to be provided to the Government a minimum of seven (7) calendar days, (unless stated other-wise stated in the SOW, per task order), prior to the scheduled Preconstruction Conference and will require Government approval prior to Notice to Proceed and work commencement on site. Make any required Pre-Construction Re-Submittals within five (5) calendar days after Government rejection. Neglect to provide timely approved Pre-Construction submittals and to employ approved key on-site Project Manager, Quality Control Manager and Superintendent personnel will not be the basis for time extension, claim under the Contract, nor will it be subject to the Disputes clause. Submit four (2) submittal copies for Government retention PLUS the number of copies requested for return back to the Contractor.

See the related Division 1 specification sections such as Quality Control, Project Schedule, Environmental Controls/Management, Waste Management, Safety Requirements:

Certificates of insurance; Surety bonds;
Qualifications, Certifications, Resumes, and Appointment Letters for Quality Control Manager, Project Manager and Superintendent; List of proposed subcontractors and suppliers;
Accident Prevention and Safety plan; Quality Control (QC) plan;
Environmental Protection and Waste Management plan; Indoor Air Quality Management Plan
Schedule
Activity Hazard Analysis(AHA)for and DOFW per Task Order

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved

Submittal is required in accordance with all contract requirements and prior to fabrication, delivery, and start of any related work activity. The Government reserves the right to suspend work activities initiated without approved submittals. Government approval is required for submittals identified in each task order. Government approval is required for any deviations from the Accepted Proposal and other items as designated by the Contracting Officer.

1.3.2 QCM Approved - Information Only

Submittals not requiring Government approval will be approved by the Quality Control Manager and made available to the Government if requested for information only. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Government from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.4.1 Submittals Required from the Contractor

Required submittals must be approved in writing by a Government Representative(PM/COR) before procurement or fabrication of any proposed materials or methods in the (SOW) per for each task order. Forward the required submittals to the Project Manager/COR and copy the Contracting Officer with the FMD-74 transmittal sheet. The Government PM for each task order will review stamp submittals to verify submittals comply with the contract requirements.

1.4.1.1 O&M Data

The Government PM for each task order will review O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

a. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to the Project Manager/COR. Transmit each copy of the submittal in the format of the Agency sample transmittal form FTC-FMD-74 furnished by the Government. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample mock-ups, installations, panels.

Properly complete this form by filling out all the heading blank spaces and identifying each item submitted by section, submittal description (SD) number, and paragraph reference number. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item. Assign each submittal a transmittal number.

1.5.2 Identifying Submittals

When submittals are provided by a lower tier contractor the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Task Order title and location.

b. Task Order number.

c. Date of the submittal.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier Contractor associated with submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. For resubmittals, add an alphabetic suffix on the submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

i. Quality Control Manager's certification stamp.

1.5.3 Format for SD-02 Shop Drawings

a. Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

b. Present A4 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."

d. Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

e. Reserve a blank space on the right hand side of each sheet for the Government disposition stamp.

f. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

g. Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

h. Reproductions of the task order drawings will not be accepted as shop drawings. Such submittals will be rejected.

1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

a. Present product data submittals for each section as a complete set. Include table of contents, listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

c. Provide product data in English dimensions.

d. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

e. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

f. Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically.

g. Submit manufacturer's instructions prior to installation.

1.5.5 Format of SD-04 Samples

a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

(1) Sample of Equipment or Device: Full size.

(2) Sample of Materials Less Than 2 by 3 inches: Built up to A4 8 1/2 by 11 inches.

(3) Sample of Materials Exceeding A4 8 1/2 by 11 inches: Cut down to A4 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

(4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

(5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

(7) Sample Panel: 4 by 4 feet.

(8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.5.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

a. Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

b. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.5.8 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

b. Provide all dimensions in administrative submittals in English units.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies on SD-01 Preconstruction Submittals

Submit four copies of Preconstruction submittals.

1.6.2 Number of Copies of SD-02 Shop Drawings

Submit three copies of submittals of shop drawings.

1.6.3 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.4 Number of Samples SD-04 Samples

a. Submit three samples or sets of samples showing range of variation, of each required item. Two approved samples or sets of samples will be retained by approving authority and one will be returned to Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit three samples of non-solid materials.

1.6.5 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.6.6 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.7 Number of Copies of SD-10 Operation and Maintenance Data

Submit two copies of O&M Data to the Government for review and approval.

1.6.8 Number of Copies of SD-11 Closeout Submittals

Unless otherwise specified, submit two sets of Close-Out submittals.

1.6.9 Copies Not Indicated

Provide two copies of submittals when a number of submittal copies are not otherwise identified.

1.7 VARIATIONS / SUBSTITUTION REQUESTS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.7.1 Considering Variations

Discussion with Contracting Officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.7.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.7.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.7.4 Variations Review Schedule

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.8 SUBMITTAL REGISTER

The Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

Coordinate the submittal dates with the related project activities to avoid any delay to work progress. Revise the submittal register when the progress schedule is revised and submit both for approval.

1.8.1 Use of Submittal Register

Verify that all submittals required for a task order are tracked in the submittal register.

1.9 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time.No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirement and refer to time period in section 1.2 Submittals.

1.9.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is the QC Manager unless submittals are specifically identified in a task order. Request for submittals in a task order signifies the requirement for Government Approval for only those submittals identified.

1.9.2 Constraints

a. Conform to provisions of this section, unless explicitly stated otherwise by a task order.

b. Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.9.3 QC Organization Responsibilities

It is the responsibility of the QC manager to coordinate all submittals with subcontractors, manufacturers, suppliers, etc. to insure all submittals are complete and represent entire systems where multiple subcontractors, supplier, etc. combine to make up an operating system.

a. Note date on which submittal was delivered by Contractor on each transmittal.

b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.

c. Review submittals for conformance with task order design concepts and compliance with contract documents.

d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

e. Ensure that material is clearly legible. Submittals containing illegible materials will be entirely rejected.

f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is Project Manager/COR, QC organization will certify submittals forwarded to Project Manager/COR with the following certifying statement:

"I hereby certify that the equipment, material, article shown and marked in this submittal is that proposed to be incorporated with contract Number__, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Certified by QC Manager_____, Date_____"
(Signature)

(2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the material, equipment, article shown and marked in this submittal and proposed to be incorporated with contract Number, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Approved by QC Manager_____, Date_____"
(Signature)

g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.

Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Government.

i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

1.10 GOVERNMENT APPROVING AUTHORITY

When approving authority for submittals is the Project Manager/COR the Government will:

a. Note date on which submittal was received from QC Manager.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph entitled "Submittal Actions" and with markings appropriate for action indicated.

Two copies of approved submittals will be retained by the Government and the remaining copies of the submittal will be returned to the Contractor, excluding O&M and Close-Out submittals.

1.10.1 Review Notations

Submittals will be returned with the following notations:

a. Submittals marked "approved" authorize the Contractor to proceed with the work covered.

b. Submittals marked "approved as noted" "or approved except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required , does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.11 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Government. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the task order drawings or specifications; notice as required under the clause entitled, "Changes" is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.12 APPROVED SUBMITTALS

The Government's approval or acceptance of submittals is not be construed as a complete check. Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for verification of dimensions and the compliant construction of all work.

After submittals have been approved or accepted by the Government, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.13 APPROVED SAMPLES

Approval of a sample is not to be construed to change or modify any contract requirements. Before submitting samples, the Contractor is to assure that the materials or equipment will be available in quantities required in the project. No substitution will be permitted after a sample has been approved.
Match the approved samples for Materials and equipment incorporated in the work. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to

disapproved any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Project Manager /COR for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Project Manager/COR does not relieve the Contractor of his responsibilities under the contract.

1.14 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made if all required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Contract.

1.15 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
E-mail: amca@amca.org
Internet: http://www.amca.org

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
2111 Wilson Blvd, Suite 500
Arlington, VA 22201
Ph: 703-524-8800
Fax: 703-528-3816
E-mail: fdietz@ahrinet.org
Internet: http://www.ahrinet.org

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209

Ph: 703-358-2960
Fax: 703-358-2961
Internet: http://www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-5774
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: webmaster@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
1 Davis Drive
P.O. Box 12215
Research Triangle Park, NC 27709
Ph: 919-549-8141
Fax: 919-549-8933
E-mail: leonardc@aatcc.org
Internet: http://www.aatcc.org

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
2025 M Street, NW, Suite 800
Washington, DC 20036
Ph: 202-367-1155
Fax: 202-367-2155
E-mail: info@americanbearings.org
Internet: http://www.abma-dc.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240
Ph: 513-742-2020 or 513-742-6163
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: http://www.acgih.org

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)
2700 Prosperity Ave., Suite 250
Fairfax, VA 22031
Tel: 703-849-8888
Fax: 703-207-3561
E-mail: infonet@aiha.org
Internet http://www.aiha.org

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 700

Chicago, IL 60601-1802
Ph: 312-670-2400
Fax: 312-670-5403
Publications: 800-644-2400
E-mail: pubs@aisc.org
Internet: http://www.aisc.org

AMERICAN IRON AND STEEL INSTITUTE (AISI)
1140 Connecticut Avenue, NW, Suite 705
Washington, DC 20036
Ph: 202-452-7100
Fax: 202-463-6577
E-mail: webmaster@steel.org
Internet: http://www.steel.org

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)
P.O. Box 210
Germantown, MD 20875-0210
Ph: 301-972-1700
Fax: 301-540-8004
E-mail: alsc@alsc.org
Internet: http://www.alsc.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1819 L Street, NW, 6th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: info@ansi.org
Internet: http://www.ansi.org/

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)
10003 Derekwood Lane, Suite 210
Lanham, MD 20706
Ph: 301-459-3200
Fax: 301-459-8077
Internet: http://www.arema.org

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191-4400
Ph: 703-295-6300 - 800-548-2723
Fax: 703-295-6333
E-mail: member@asce.org
Internet: http://www.asce.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: http://www.ashrae.org

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

1800 East Oakton Street Des
Plaines, IL 60018-2187
Ph: 847-699-2929
Fax: 847-768-3434
E-mail: customerservice@asse.org
Internet:http://www.asse.org

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
901 Canterbury, Suite A
Westlake, OH 44145
Ph: 440-835-3040
Fax: 440-835-3488
E-mail: info@asse-plumbing.org
Internet: http://www.asse-plumbing.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Ph: 800-926-7337
Fax: 303-347-0804
E-mail: smorrison@awwa.org
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
550 N.W. LeJeune Road
Miami, FL 33126
Ph: 800-443-9353 - 305-443-9353
Fax: 305-443-7559
E-mail: info@aws.org or customerservice@awspubs.com
Internet: http://www.aws.org

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
E-mail: email@awpa.com
Internet: http://www.awpa.com

APA - THE ENGINEERED WOOD ASSOCIATION (APA)
7011 South 19th St.
Tacoma, WA 98466-5333
Ph: 253-565-6600
Fax: 253-565-7265
E-mail: help@apawood.org
Internet: http://www.apawood.org

ARCHITECTURAL WOODWORK INSTITUTE (AWI)
46179 Westlake Drive, Suite 120
Potomac Falls, VA 20165
Ph: 571-323-3636
Fax: 571-323-3630
E-mail: info@awinet.org
Internet: http://www.awinet.org

ARCNET TRADE ASSOCIATION (ATA)

E-M-mail: info@arcnet.com
Internet: http://www.arcnet.com/index.htm</URL

ASME INTERNATIONAL (ASME)
Three Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-854-7179 or 800-843-2763
Fax: 212-591-7674
E-mail: infocentral@asme.org
Internet: http://www.asme.org

ASSOCIATED AIR BALANCE COUNCIL (AABC)
1518 K Street, NW
Washington, DC 20005
Ph: 202-737-0202
Fax: 202-638-4833
E-mail: info@aabc.com
Internet: http://www.aabchq.com

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9585
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
355 Lexington Avenue
15th Floor
New York, NY 10017
Ph: 212-297-2122
Fax: 212-370-9047
E-mail: assocmgmt@aol.com
Internet: http://www.buildershardware.com

CALIFORNIA ENERGY COMMISSION (CEC)
Media and Public Communications Office
1516 Ninth Street, MS-29
Sacramento, CA 95814-5512
Ph: 916-654-4287
Internet: http://www.energy.ca.gov/

CARPET AND RUG INSTITUTE (CRI)
P.O. Box 2048
Dalton, GA 30722-2048
Ph: 800-882-8846 or 706-278-3176
Fax: 706-278-8835
Internet: http://www.carpet-rug.com

CAST IRON SOIL PIPE INSTITUTE (CISPI)
5959 Shallowford Road, Suite 419
Chattanooga, TN 37421
Ph: 423-892-0137
Fax: 423-892-0817
Internet: http://www.cispi.org

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)
1300 Sumner Avenue
Cleveland OH 44115-2851
Ph: 216-241-7333
Fax: 216-241-0105
E-mail: cffa@chemicalfabricsandfilm.com
Internet: http://www.chemicalfabricsandfilm.com/

COMPOSITE PANEL ASSOCIATION (CPA)
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176
Ph: 703-724-1128
Fax: 703-724-1588
Internet: http://www.pbmdf.com

COMPRESSED GAS ASSOCIATION (CGA)
4221 Walney Road, 5th Floor
Chantilly, VA 20151
Ph: 703-788-2700
Fax: 703-961-1831
E-mail: cga@cganet.com
Internet: http://www.cganet.com

CONSUMER ELECTRONICS ASSOCIATION (CEA)
1919 South Eads St.
Arlington, VA 22202
Ph: 866-858-1555 or 703-907-7600
Fax: 703-907-7675
E-mail: cea@CE.org
Internet: http://www.CE.org

COPPER DEVELOPMENT ASSOCIATION (CDA)
260 Madison Avenue
New York, NY 10016
Ph: 212-251-7200
Fax: 212-251-7234
E-mail: questions@cda.copper.org
Internet: http://www.copper.org

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)
513 West Broad St., Suite 210
Falls Church, VA 22046-3257
Ph: 800-294-3462
Fax: 703-538-1736
E-mail: lwidzowski@eima.com
Internet: http://www.eima.com

FLUID SEALING ASSOCIATION (FSA)
994 Old Eagle School Rd. #1019
Wayne, PA 19087
Ph: 610-971-4850
E-mail: info@fluidsealing.com
Internet:www.fluidsealing.com

FM GLOBAL (FM)
270 Central Avenue

P.O. Box 7500
Johnston, RI 02919
Ph: 401-275-3000 ext. 1945
Fax: 401-275-3029
E-mail: servicedesk.myrisk@fmglobal.com
Internet: http://www.fmglobal.com

FOREST STEWARDSHIP COUNCIL (FSC)
212 Third Avenue North
Suite 280 Minneapolis,
MN 55401
Ph: 612-353-4511
Fax: 612-208-1565
E-mail: info@fscus.org
Internet: http://www.fscus.org

GEORGIA DEPARTMENT OF NATURAL RESOURCES

2 Martin Luther King Jr. Drive, SE
Suite 1252, East Tower
Atlanta, GA 30334
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PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00

CONSTRUCTION QUALITY CONTROL AND KEY PERSONNEL

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Requirements of this Section apply to, and are component of, each section of the specifications.

1.2 DEFINITIONS

Reference to the Government COR and Construction Representative (ConRep) herein refers to the FLETC Facilities Management Division Project Manager and Construction Representative.

1.3 SUBMITTALS

Approval is required for submittals as identified by each task order. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

The below listed Pre-Construction Submittals are critical to start of work activities and are required to be provided to the Government a minimum of seven (7) calendar days prior to the scheduled kick-off Preconstruction Conference All Pre-Construction submittals require Government approval. Make any required Pre-Construction Re-Submittals within five (5) calendar days after Government rejection. Neglect to provide timely approved Pre-Construction submittals and to employ approved key on-site Project Manager, Quality Control Manager and Superintendent personnel will not be the basis for time extension, claim under the Contract, nor will it be subject to the Disputes clause. Submit four (4) submittal copies for Government retention PLUS the number of copies requested for return back to the Contractor.

Construction Quality Control (QC) Plan;

Submit a QC Plan in accordance with the requirements of this Section. Acceptance of the QC Plan is required prior to start of construction work.

Key Personnel Resumes, Qualifications, Letters of Commitment, Certificates and Appointment Letters;

Key personnel are the Contractor's: Project Manager (PM), Alternate PM, Quality Control Manager (QCM), Alternate QCM, Superintendent, and Alternate Superintendent. Alternates are held to the same standards as the primary position holders. Requirements specified herein for the primary PM, CQM, and Superintendent position holders are equally applicable to the Alternate position holders when they are serving in their designated alternate position capacity.

Upon initial solicitation key personnel were vetted and the associated skill sets considered. Should replacement personnel be deemed prudent by the Contractor, the individual replacement personnel shall have equal or greater skill set than the person they are replacing. Prior to replacement of those key positions outlined, the contractor shall submit qualifications and experience in resume format. Include: resume; letters of commitment attesting to the candidates' availability signed by an officer of the Contractor and the proposed candidates; and appointment letters signed by an officer of the Contractor for review and approval. Submit qualifications and experience information in resume format and include attachments as necessary. Include formal educational experience, copies of diplomas and training certificates, chronological work history, positions held, descriptions of duties and responsibilities, relevant project descriptions and demonstration of satisfaction of the required qualifications. Provide additional information as requested.

Submit for Government review no later than seven (7) calendar days prior to the scheduled replacement.

Acceptable key personnel qualifications, performance, and organizational observance of required PM, QCM and Superintendent authorities are considered critical to success of task orders executed under this contract. Required authorities of the PM, QCM and Superintendent are described in this Section and are to be acknowledged in the Appointment Letters. Government approval of replacement key personnel is necessary prior to assignment of the replacement.

Contractor Safety Plan;

Provide a comprehensive Safety Plan in accordance with the related Section for SAFETY REQUIREMENTS. The Safety Plan comprises, but is not limited to, an Accident Prevention Plan (APP), Activity Hazard Analysis (AHA), Health and Safety Plan, provision of proposed Safety Officer Training Records and Qualifications.

Contractor Environmental Plan;

Provide a comprehensive Environmental, Indoor Air Quality and Waste Management Plan in accordance with the related Sections for CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT and TEMPORARY ENVIRONMENTAL CONTROLS. Provide required Environmental Officer Training Records and Qualifications.

1.4 REPORTING FORMS

Use reporting forms provided in the contract or obtain a single copy of forms from the Facilities Management COR. The report forms will consist of the Superintendent's Daily Report (FTC-FMD-42) and the Quality Control Manager's Daily Report (FTC-FMD-67). Other forms shall be developed by the Contractor and submitted for approval of the Government for reporting of QC Meeting Agendas and Minutes, Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, Requests For Information (RFI), Field Test

Reports, and Testing Plan and Log. Submit electronic daily reports via email to both the Facilities Management Division. Copy the Government COR /Pm, and ConRep (if assigned).

Deliver the following to the assigned Government task order Project Manager during Construction:

a. Superintendent's and QCM's Reports: Electronically transfer completed and signed daily reports to the Facilities Management Division assigned Project Manager and Contracting Officer by 10:00 AM the next working day. Provide daily reports for all working and non-working days through the date of final acceptance of all work. Annotate non-working days accordingly on reports.

b. Preparatory Phase Checklist: Original attached to the original QCM Report and one copy attached to each QCM Report copy.

c. Initial Phase Checklist: Original attached to the original QCM Report and one copy attached to each QCM Report copy.

d. Field Test Reports: Hand-carry the original within two working days after the test is performed, attached to the original QCM Report and one copy attached to each QCM Report copy.

1.5 KEY PERSONNEL AND QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. This QC program is a key element in meeting all project objectives of timely and quality performance. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), QC meetings, three phases of control, submittal review and approval, testing, completion inspections, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No construction work or testing may be performed without an approved Quality Control Manager AND Superintendent being physically present on the FLETC premises. Duties requiring departure from the site during any work activities shall be performed by personnel other than the QC Manager and Superintendent. Absence of these key personnel or their approved alternates from the FLETC premises during work activities can result in work stoppage, contract price reduction, staffing removal, and/or other actions as determined by the Government. The QC Manager shall report to an Officer of the firm and shall not be subordinate to the field Project Manager or Superintendent. The QC Manager, PM and Superintendent must work together effectively. Although the QC Manager is the primary individual responsible for quality control, the PM and Superintendent are accountable for the quality of work produced under their supervision. The Contractor shall maintain a competent approved PM, QCM and Superintendent at the FLETC premises at all times work is being performed.

Designated Alternate key personnel must be available on-site in the event of absence of the primary key person(s).

1.5.1 Commissioning

Commissioning (Cx) is a systematic process of ensuring that all building systems meet the requirements and perform interactively according to the Contract. The QC Program is a key to this process by coordinating, verifying and documenting measures to achieve the following objectives:

a. Verify and document that the applicable equipment and systems are installed in accordance with the design intent as expressed through the Contract and according to the manufacturer's recommendations and industry accepted minimum standards.

b. Verify and document that equipment and systems receive complete operational checkout by the installing contractors.

c. Verify and document proper performance of equipment and systems.

d. Verify that Operation and Maintenance (O&M) documentation is complete.

e. Verify and document that the Government's operating personnel are adequately trained.

1.5.2 Acceptance of the Construction Quality Control (QC) Plan and Key Personnel

Acceptance of the QC Plan is required prior to the start of construction activities. The Government reserves the right to require changes in the QC Plan and operations as necessary. The Government reserves the right to interview any personnel at any time in order to evaluate and verify personnel qualifications and a suitable level of work performance. The PM, Superintendent and QCM organization personnel shall be subject to acceptance by the COR. If at any time during the Contract performance period, should key personnel's job performance fall below a reasonable standard of competence, professionalism, attendance, or should performance be otherwise objectionable, he/she shall be promptly replaced by the Contractor upon request from the Government. Neglect to maintain an effective Quality Control Program and acceptable key Quality Control and Superintendent Personnel will not be the basis for claim under the Contract nor will it be subject to the Disputes clause. All persons are subject to a background criminal investigation at the discretion of the Federal Law Enforcement Training Center.

1.5.3 Notification of Changes

Notify the COR/PM, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel, a minimum of 10 work days prior to a proposed change. Proposed changes shall be subject to acceptance by the COR. Notify the COR in advance when the Alternate PM, QCM or Superintendent will temporarily assume duties as necessitated by an absence of the primary person(s).

1.6 CONTRACTOR KEY PERSONNEL

All key personnel shall be direct employees of the prime Contractor and shall be on-site on normal working days at least between the Normal hours of 7:30 a.m. and 4:30 p.m. At a minimum, one (1) of the key personnel (Project Manager, Project Superintendent, QC Manager and alternates, if

applicable) must always be onsite during Normal hours.

1.6.1 Quality Control Manager (QCM)

1.6.1.1 Duties

Provide an on-site QC Manager to implement and manage the QC program. The QC Manager shall devote his time exclusively to work under this contract only. The QC Manager shall devote his time exclusively to the work under this contract only and shall be on-site at least on normal working days between the Normal hours of 7:30 a.m. and 4:30 p.m. The QC Manager shall: administer the three phases of quality control, have the authority to stop work, require work replacement, direct subcontractor performance with regard to quality, issue and enforce Contractor non-compliance notices with respect to all work. The QC Manager shall not be designated as the safety competent person as defined by the adopted U.S. Army Corps of Engineers (USACE) Safety Manual EM 385-1-1. The QC Manager is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meeting, Progress Meetings, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of quality control and documentation performed by testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

1.6.1.2 QC Manager Qualifications

As a minimum, the individual shall demonstrate completion of High School level education. The individual shall possess a total cumulative minimum of ten (10) years combined experience on similar private or Federal construction projects in the following positions: Project Superintendent, QC Manager, Project Manager, or Construction Manager. Of this cumulative experience, at least five years' experience shall be as a QC Manager on similar United States Military or Federal agency construction contract. Similar construction contracts are defined to be of comparable cost, type and complexity of work and including the major trades that are part of this Contract. The individual shall be experienced with Federal administrative construction processes. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). In addition to the above experience and education requirements, the QC Manager shall have completed the course entitled "Construction Quality Management (CQM) for Contractors." If the QC Manager does not have a current certification, he/she shall obtain the CQM for Contractors course certification within 30 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact these organizations for information on the next scheduled class. The individual must be familiar with the safety requirements of USACE EM 385-1-1 and/or OSHA 1926 Construction and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, Outlook (e-mail). The individual must demonstrate a working

knowledge and familiarity with Critical Path Network scheduling and be familiar with MS Project or similar project management software.

1.6.1.3 Alternate QC Manager Duties and Qualifications

The Government approved and authorized alternate QC Manager shall be available on-site to serve in the event of the designated primary QC Manager's absence. The Alternate QC Manager Qualifications shall be the same the QC Manager's.

1.6.2 Superintendent

1.6.2.1 Duties

The Contractor shall employ, on-site at the project location, a full time Superintendent who shall be subject to approval by the Government prior to Notice to proceed being given. The Superintendent shall devote his time exclusively to the supervision of work under this contract only and shall be on-site at least on normal working days between the Normal hours of 7:30 a.m. and 4:30 p.m. and at all times during the active performance of construction activities. The Superintendent is not to self-perform work activities. The Superintendent shares a high level of responsibility for management and production of timely and quality conforming work. The Superintendent shall have the authority to act for the Contractor with the same force and effect of the project manager. There may be multiple job sites with work in progress at the same time. The Superintendent shall visit each site a minimum of once a day when work is being performed, supervise and monitor work performance and accurately report activities in daily reports.
Autonomy of the on-site superintendent is critical to the smooth operation of FLETC requirements.

The QC Management organization is not subordinate to the Superintendent. An Appointment Letter delegating these authorities shall be signed by a Principle Officer of the firm and submitted to the COR along with the Superintendent's resume for approval. The Superintendent is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meeting, and conduct Progress Meetings. The Superintendent will conduct frequent and routine meetings with Contractor and Subcontractor personnel to: coordinate trade work performance, review schedule objectives for definable features of work, coordinate work conformance to approved submittals, plan and sequence the orderly progress of trade work, correct work deficiencies, maintain job site safety, address material and equipment delivery and proper storage, ensure environmental compliance, ensure testing is satisfactorily, and conduct other related supervisory duties as necessary. The Superintendent may be designated as the safety competent person as defined by the adopted U.S. Army Corps of Engineers (USACE) Safety Manual EM 385-1-1. Computer proficiency is required in such software systems as Word, Excel, Outlook (e-mail) and MS Project/Primavera. The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling.

1.6.2.2 Superintendent Qualifications

An individual with a minimum of fifteen (10) years combined experience in the following positions: Project Superintendent, QC Manager, Project Manager, or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract

The individual shall have at least five (5) years of experience as a Superintendent on similar size, complexity and type contracts. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail).

The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.2.3 Alternate Superintendent Duties and Qualifications

The Government approved and authorized alternate Superintendent shall be available on-site to serve in the event of the designated primary Superintendent’s absence. The Alternate Superintendent's duties and qualifications shall be the same as the Superintendent's

The individual shall have at least five (5) years of experience as a Superintendent on similar size, complexity and type contracts. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail).

The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.2.4 Alternate Superintendent Duties and Qualifications

The Government approved and authorized alternate Superintendent shall be available on-site to serve in the event of the designated primary Superintendent's absence. The Alternate Superintendent's duties and qualifications shall be the same as the Superintendent's.

1.6.3 Project Manager

1.6.3.1 Duties

The Contractor shall employ a Project Manager, subject to approval by the Government prior to Notice to Proceed being given. The Project Manager shall devote his time exclusively to this contract and shall be on-site on normal working days at least between the Normal hours of 7:30 a.m. and 4:30 p.m. The PM will be the Government's primary point of contact for this contract. PM is also responsible for day-to-day task order management and administration. The PM is not to self-perform work activities. The PM shares a high level of responsibility for management and production of timely and quality conforming work. The QC Management organization is not subordinate to the PM. The PM shall be delegated authority by the Contractor to sign contract modifications, negotiate and reach agreement for the Contractor on matters such as change orders, time extensions, and other issues arising under the contract which may lead to contract modification in accordance with FAR 52- 236-6. An Appointment Letter delegating these authorities shall be signed by a Principle Officer of the firm and submitted to the Government. An original signature copy of this delegation of authority shall be provided to the Contracting Officer with the Project Manager's resume. The PM is required to attend QC Plan Meetings, Coordination and Mutual Understanding Meetings, and Progress Meetings.

1.6.3.2 PM Qualifications

An individual with a minimum of fifteen (10) years combined experience in the following positions: Project Manager, Project Superintendent, QC Manager, or Construction Manager with the last five (5) years' experience as a Project Manager on specific IDIQ, SABER, or JOC contracts within the minimum range of at $3M or above, with a performance period of

more than one year. The Project Manager must have been employed directly by the prime contractor and served in that capacity for the duration of the contract. The individual must possess and demonstrate extensive experience and a working knowledge in the full range of trades and disciplines typical to work under this contract (For example: architectural work and finishes, carpentry, structural, earthwork, pavement, utilities, concrete, heating, ventilation and air conditioning, piping, plumbing, fire alarm and protection, electrical distribution systems, lighting, lightning protection, telecommunications, multi-media, and interior furnishings). As a minimum, the individual shall demonstrate completion of High School level education. The individual must be familiar with the safety requirements of EM 385-1-1 and/or OSHA 1926 Construction, have a valid 30-hour Construction OSHA Certification Card, and have experience in the areas of hazard identification, safety compliance, and sustainability. Computer proficiency is required in such software systems as Word, Excel, and Outlook (e-mail). The individual must demonstrate a working knowledge and proficiency with Critical Path Network scheduling and with MS Project or similar project management software.

1.6.3.3 Alternate PM Duties and Qualifications

The Government approved and authorized alternate Project Manager shall be available on-site to serve in the event of the designated primary Project Manager's absence. The Alternate PM's duties and qualifications shall be the same as the Project Manager's.

1.6.4 Key Personnel Resume Requirements

1.6.4.1 Acceptable key personnel qualifications, performance, and organizational observance of required authorities are considered critical to the project.

1.6.4.2 Offeror's shall initially submit their proposed primary and alternate key personnel resumes and letters with the technical proposal during the contract solicitation phase. Submit primary and alternate Key Personnel resumes and letters as described in paragraph 1.3 Key Personnel Resumes, Qualifications, Letters of Commitment, Certificates and Appointment Letters; Any approvals of proposed key personnel are contingent upon the Government's review and approval of key personnel and satisfactory background investigations. Award of a contract does not imply acceptance of the proposed key personnel. Acceptance occurs post-award.

1.6.4.3 Post-award and a minimum of seven (7) calendar days prior to the scheduled Preconstruction Conference, the Contractor shall again submit the documents required by paragraph 1.3 for formal Government review and approval of all key personnel. Submission of resumes failing to demonstrate compliant qualifications will be rejected.

1.6.4.4 Any subsequent proposed change in key personnel requires submission of the resume and other documents for Government review and approval.

1.6.5 Commissioning Authority

1.6.5.1 Duties

If required by a task order, provide a Commissioning Authority (CA) as key

person for the commissioning (Cx) and documentation thereof, who is subordinate to the QC Manager. The CA shall direct and coordinate Cx activities and submit Cx reports to the COR to meet the submittal and reporting requirements of Commissioning. The CA shall coordinate the actions of the QC Specialists, Testing Laboratory personnel, and other inspection and testing personnel required by this Contract for building Cx.

1.6.5.2 Qualifications

The CA must be certified as a commissioning professional by the Association of Energy Engineers (AEE), the Building Commissioning Association (BCA), the National Environmental Balancing Bureau (NEBB). CA resume is required, providing education, experience and management capabilities on at least two similar size and type contracts. The CA may not have been involved with the project design, construction management, or supervision, and must be with a third-party firm that is not on the design team.

1.7 QUALITY CONTROL (QC) PLAN

1.7.1 Construction Quality Control (QC) Plan

1.7.1.1 Requirements

A QC Plan shall be submitted for review and approval a minimum of seven (7) calendar days prior to the scheduled Preconstruction Conference. Provide, for acceptance by the COR, a Construction QC Plan submitted in a three-ring binder that includes a table of contents, with major sections identified with tabs as listed below, with pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing commissioning activities during the construction of the project. The Contractor is responsible to incorporate any review comments into the Final Plan and obtaining Government approval of the Plan prior to start of work activities as described by the paragraph "Acceptance of the Construction Quality Control Plan".

I. QC ORGANIZATION: A chart showing the QC organizational structure.

II. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format as described by the paragraph "Key Personnel Resume Requirements", for each person in the QC organization. Include all supporting documents demonstrating compliance with the stated qualifications to include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "QC Manager Qualifications".

III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

V. APPOINTMENT LETTERS: Letters signed by a principle officer of the firm appointing the PM, QC Manager, Superintendent, Alternate PM, Alternate QCM and Alternate Superintendent describing and delegating the required duties and authorities required in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work which is not in compliance with the Contract. The QC Manager shall issue letters of direction to all other QC personnel outlining their duties, authorities, and responsibilities. Copies of the letters shall be included in the QC Plan.

VI. SUBMITTAL PROCEDURES: Procedures for reviewing, approving, and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.

VII. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs entitled "Accreditation Requirements", as applicable.

VIII. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, document corrective action plans and complete rework items. Include proposed forms to record and track rework items.

IX. DOCUMENTATION PROCEDURES: Include proposed forms and provide copies of the Government furnished QCM and Superintendent daily report forms.

X. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures you will use to ensure the three phases of control are used to manage the quality on this project.

XI. ORGANIZATIONAL MATRIX: A matrix showing organizational structure and hierarchal relationships of key field staff and home office management.

XII. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.

XIII. TRAINING PROCEDURES AND TRAINING LOG: Procedures for coordinating and documenting the training of personnel required by the Contract.

XIV. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

1.8 QC PLAN MEETINGS

The QC Manager will meet with the COR to discuss the QC Plan requirements of this Contract as required.

1.9 COORDINATION AND MUTUAL UNDERSTANDING MEETINGS

After submission of the QC Plan, and prior to the start of construction work, the QCM will meet with the COR to present the QC program required by this Contract. When a new QC Manager is appointed, the coordination and mutual understanding meeting shall be repeated.

1.9.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how three phases of control will be implemented.

a. Waste Management Plan.

b. Indoor Air Quality (IAQ) Management Plan.

c. Procedures for noise and acoustics management.

d. Environmental Protection Plan.

e. Environmental regulatory requirements.

f. Commissioning (Cx) Plan.

1.9.2 Coordination of Activities

Activities included in various sections shall be coordinated to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation. Schedule construction operations with consideration for indoor air quality as specified in the IAQ Management Plan.

1.9.3 Attendees

As a minimum, the Contractor's personnel required to attend shall include PM, Superintendent, and QC Manager. The Contractor shall provide a copy of the signed minutes to all attendees and a copy shall be included in the Final QC Plan.

1.10 QC MEETINGS

After the start of construction, the QC Manager shall conduct routine QC meetings at the field office with the PM, Superintendent, and the subcontractor foremen. The QC Manager shall prepare the minutes of the meeting and provide a copy to the COR within two working days after the meeting. Government personnel may attend these meetings. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work and rework;

c. Review the status of submittals;

d. Review work and testing accomplished since the last meeting;

e. Address rework items identified since the last meeting;

f. Address rework items corrected since the last meeting;

g. Review the work to be accomplished in the next two weeks and documentation required;

h. Resolve QC and production problems (RFI, etc.);

i. Address items that may require revising the QC Plan;

j. Review Accident Prevention Plan (APP);

k. Review environmental requirements and procedures;

l. Review Waste Management Plan;

m. Review IAQ Management Plan;

n. Review Environmental Management Plan;

o. Review the status of training completion; and

p. Review commissioning (Cx) Plan and progress, if applicable.

1.11 DESIGN REVIEW AND DOCUMENTATION

1.11.1 Design Review

If applicable, the CA shall review design documents to verify that each commissioned system meets the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. Fully document review in written report.

1.11.2 Contract Document Review

The CA shall review the Contract documents to verify that each commissioned system is likely to meet the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts.

1.12 THREE PHASES OF CONTROL

The Three Phases of Control shall adequately cover both on-site and off-site work and shall include the following.

1.12.1 Preparatory Phase

Notify the Government PM at least two work days in advance of each preparatory phase meeting. The meeting shall be conducted by the QC Manager and attended by the Project Superintendent and the foreman responsible for the Definable Feature of Work (DFOW). When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman shall attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFOW:

a. Review each paragraph of the applicable specification sections;

b. Review the Contract drawings;

c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders in order to coordinate work and avoid dimensional errors and rework;

d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;

e. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

f. Examine the work area to ensure that the required preliminary work has been completed;

g. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials;

h. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

i. Discuss construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW;

j. Review the Accident Prevention Plan (APP) and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

k. If applicable, review the Commissioning (Cx) Plan and ensure all preliminary work items have been completed and documented.

1.12.2 Initial Phase

Notify the Government PM at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the Project Superintendent, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the

results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each DFOW:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Ensure that testing is performed by the approved laboratory;

d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met; and

e. If applicable, review the Cx Plan and ensure all preparatory work items have been completed and documented.

1.12.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report:

a. Ensure the work is in compliance with Contract requirements;

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed by the approved laboratory;

d. Ensure that rework items are being corrected;

e. Perform safety inspections; and

f. If applicable, review the Cx Plan and ensure all work items, testing, and documentation has been completed.

1.12.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

1.13 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES. Submittals requiring Government approval will be identified by each task order and are to be scheduled and made prior to the acquisition of the material or equipment covered thereby. Submittals not requiring Government approval will be approved by the Quality Control Manager and made available to the Government if requested for information only. All submittals shall be reviewed and certified compliant by the QCM.

1.14 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.14.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.14.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at http://ts.nist.gov/ts/htdocs/210/214/214.htm, the American Association of State Highway and Transportation Officials (AASHTO) program at http://www.transportation.org/aashto/home.nsf/frontpage, International Accreditation Services, Inc. (IAS) at http://www.iasonline.org, U. S. Army Corps of Engineers Materials Testing Center (MTC) at http://www.wes.army.mil/SL/MTC/, the American Association for Laboratory Accreditation (A2LA) program at http://www.a2la.org/, the Washington Association of Building Officials (WABO) at http://www.wabo.org/.

1.14.3 Capability Check

The Government retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.14.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Project Manager immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Within five (5) days of testing, furnish the signed reports, certifications, and other documentation to the Project Manager via the QC Manager and the Daily QC Report. Full payment for work subject to testing is dependent upon successful testing.

1.15 QC CERTIFICATIONS

1.15.1 CQC Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.15.2 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Government attesting that "the work has been completed, inspected, tested and is in compliance with the Contract."

1.16 COMPLETION INSPECTIONS

1.16.1 Punch-Out Inspection

Near the completion of all work on a task order or any increment thereof, established by a completion time stated in the task order, the QC Manager shall self-perform an inspection of the work and develop a "punch list" of items which do not conform to the contract documents. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch-Out Inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. Four copies of the punch list shall be provided to the Government. The QC Manager shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall certify in writing to the Government that Punch-Out work is satisfactorily completed and the facility is ready for the Government "Pre-Final Inspection". Allow a minimum of two (2) working days for Government coordination of the start of Pre-Final Inspection.

1.16.2 Pre-Final Inspection

The Government will perform this inspection to verify that the task order is complete. The Government may terminate Pre-Final Inspection at any time should it be determined the work has not been satisfactorily completed or that previously documented deficiencies remain incomplete. In such an instance the Contractor shall resume and progress Punch-Out work and the QCM shall repeat the Punch-Out Inspection. A Government "Pre-Final Punch List" may be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the Client can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner and shall be accomplished before the task order completion date for the work, or any particular increment thereof, if the project is divided into increments by separate completion dates.

1.16.3 Final Acceptance Inspection

The QCM shall coordinate with the Government PM the date a task order final acceptance inspection can be held. The notice shall certify in writing that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the proposed date of the final acceptance inspection. The Contractor shall be represented by the QC Manager, Superintendent, the CA if applicable, and

others deemed necessary. Attendees for the Government may include the Project Manager, COR, and personnel representing the Client.

1.17 TRAINING

Prior to request for "Pre-final Inspection" of a task order by the QC Manager, provide Government personnel training for the systems and equipment if specified by a task order. The trainees shall include the Government's Project Manager, ConRep, facilities managers, maintenance staff, and key building occupants. The Contractor shall be responsible for coordinating, scheduling, and ensuring that training is completed. Instructors shall have a working knowledge and be well-versed in the particular systems that they are presenting. Provide instruction time on site at a location approved by the Government Project Manager.

1.17.1 Content

Training shall stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The core of this training will be based on manufacturer's recommendations and the operation and maintenance information provided as a part of this Contract. A review of environmentally-related aspects of the Operation and Maintenance Manuals shall be included. The following shall be included for each system:

a. Design intent based on the contract documents.

b. Use of O&M Manuals.

c. Review of control drawings and schematics.

d. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

e. Interactions with other systems.

f. Adjustments and optimizing methods for energy conservation.

g. Relevant health and safety issues.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

j. Discussion of how the feature or system is environmentally responsive.

1.17.2 Building Systems Training

The QCM shall be responsible for coordination of all building systems training with the Government. Prior to Punch-Out of a task order, provide the Government Project Manager a comprehensive listing of the building systems training and the proposed training schedule for each course. Training course schedules are subject to Government coordination and

approval. The Contractor will provide each trainee in the course a written course outline and training manual, listing the major and minor topics to be discussed by the instructor on each day of the course. Assume a maximum of ten (10) trainees in any single system course of training. The QCM shall record training minutes and a sign-in list containing attendees' names/organizations. Submit to the Government Project Manager a record of training agendas, minutes, and attendees within five (5) calendar days of completion of each training course.

1.18 DOCUMENTATION

1.18.1 Construction Documentation

Reports are required for each day that work is performed and shall accompany the Contractor Quality Control Daily Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign their respective daily reports. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.18.2 Quality Control Field Office Library

Establish and maintain the following library of information at the site Contractor field office in a series of separate three ring binders. Binders shall be identified, divided and tabbed for the orderly presentation of information. These binders shall be maintained, readily and publicly accessible in the field office to Government personnel during all business hours.

a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.

b. All milestone inspections.

c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.

d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

e. An up-to-date copy of the Rework Items List and the related Corrective Action Plans.

f. Maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the Government.

g. Commissioning documentation including Cx checklists, schedules, tests, and reports.

h. Training Log, training agendas, attendees list, training manuals, training verification forms and other supporting documentation.

i. Copies of Field Change and Variance Logs arranged numerically in a chronological order recording all Government approved field changes and variances. Use the Government approved form for Variances. Include description of the subject specification or drawing reference, related correspondence and documents, and documentation of Field Change or Variance approval from the Project Manager.

j. Testing Plan and Log including all test reports and approvals organized and tabbed by specification section.

k. Request For Information (RFI) Log including copies of all RFI's and the responses arranged in a numerical order.

l. Submittal Log including a comprehensive listing of all submittals required by the contract documents with delivery dates and actions taken. Organize and tab by specification section.

m. Contractor Construction Compliance Notice (CCCN) Log including copies of all original signed compliance notices arranged in numerical order. Include descriptions of problems, corrective actions, and dates of correction completion.

o. Listing of all Subcontractors and emergency contact information for each.

1.18.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Government Project Manager. Attach a copy of the updated "Testing Plan and Log" to the Daily CQC Report.

1.18.4 Rework Items List and Corrective Action Plans

The QC Manager shall maintain a list of work that does not comply, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. Provide detailed written Corrective Action Plans to the Government Project Manager as requested in association with rework items. Corrective action plans shall be presented in narrative format with supporting drawings, product information, submittals, and other documents as required. Do not progress work without written Government Project Manager approval of Corrective Action Plans. Make changes to Corrective Action Plans as required by the Government. Remove and replace non-compliant or deficient work as instructed. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to each Progress Meeting Agenda and to the last daily

CQC Report of each month. The Contractor shall be responsible for including those items identified by the Government.

1.18.5 As-Built Drawings

The QC Manager is required to ensure the as-built drawings, if required, are kept current on a daily basis and marked to show deviations which have been made from the task order drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. Field Change No., Variance No., Modification No., Request for Information No., etc.). The QC Manager shall initial each revision.

1.19 NOTIFICATION OF NON-COMPLIANCE

The Government will notify the Contractor of detected non-compliance with the Contract. Such notice, when verbally delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. The Government may, at its discretion, issue Construction Contractor Compliance Notices (CNNN's) or other written documentation concerning a non-complaint work. The Contractor shall take immediate steps to bring work into compliance. When a Corrective Action Plan is required by the Government, no corrective work shall occur prior to Government Project Manager approval of the Corrective Action Plan. If the Contractor fails or refuses to promptly bring work into compliance, the Government may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time for excess costs or damages by the Contractor.

1.20 CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

An IAQ Management Plan shall be submitted not less than 10 days before the Preconstruction Conference. Revise and resubmit Plan as required by the Government. Copies of the final Plan shall be made available to all workers on site. Include provisions in the Plan to meet the requirements specified below and to ensure safe, healthy air for construction workers and building occupants.

1.20.1 Requirements During Construction

Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D 6245. Provide for evaluation of volatile organic compounds (VOCs) in indoor air in accordance with ASTM D 6345. Use filters with a Minimum Efficiency Reporting Value (MERV) of 8 in permanently installed air handlers during construction.

1.20.1.1 Control Measures

The Contractor shall meet or exceed the requirements of SMACNA 1507, Chapter 3, to help minimize contamination of the building from construction activities. The five requirements of this manual which must be adhered to are described below:

a. HVAC protection: Isolate return side of HVAC system from surrounding environment to prevent construction dust and debris from entering the duct work and spaces.

b. Source control: Use low emitting paints and other finishes, sealants, adhesives, and other materials as specified. When available, cleaning products shall have a low VOC content and be non-toxic to minimize building contamination. Utilize cleaning techniques that minimize dust generation. Cycle equipment off when not needed. Prohibit idling motor vehicles where emissions could be drawn into building. Designate receiving/storage areas for incoming material that minimize IAQ impacts.

c. Pathway interruption: When pollutants are generated use strategies such as 100 percent outside air ventilation or erection of physical barriers between work and non-work areas to prevent contamination.

d. Housekeeping: Clean daily to remove construction dust and debris. Promptly clean up spills. Remove accumulated water and keep work areas dry to discourage the growth of mold and bacteria. Take extra measures when hazardous materials are involved.

e. Scheduling: Control the sequence of construction to minimize the absorption of VOCs by other building materials.

1.20.1.2 Moisture Contamination

a. Remove accumulated water and keep work dry.

b. Use dehumidification to remove moist, humid air from a work area.

c. Do not use combustion heaters or generators inside the building.

d. Protect porous materials from exposure to moisture.

e. Remove from the site and replace water damaged items as directed by the Project Manager.

1.20.2 Requirements After Construction

After construction ends, replace HVAC filtration media.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

3.2 GOVERNMENT QUALITY ASSURANCE

In accordance with FAR 52.246-12, Inspection of Construction:

a. Government inspections and tests are for the sole benefit of the Government and do not-

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;
(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;
(3) Constitute or imply acceptance; or
(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

b. The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the task order specification.

c. The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Project Manager. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work.

d. The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

e. If the Contractor does not promptly replace or correct rejected work, the Government may-

(1) By contract or otherwise, replace or correct the work and charge the cost to the Contractor; or
(2) Terminate for default the Contractor's right to proceed.

f. If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Government shall make an equitable adjustment for the additional services involved in the examination and

reconstruction, including, if completion of the work was thereby delayed, an extension of time.

3.3 GOVERNMENT ACCEPTANCE

The performance and quality of work delivered by the Contractor, including services rendered and any documentation, shall be subject to inspection, review, and acceptance by the Government. All work shall be completed within the time specified in the contract, including provision of close-out documents and correction of deficiencies noted during the final inspection.

3.4 WARRANTY RESPONSIBILITIES

The Contractor shall perform quality control duties in relation to warranty work. Provide a knowledgeable and competent person on site to coordinate, supervise, and to execute quality control processes on warranty work. Perform final inspection of warranty work and promptly notify the Government of the compliant completion of warranty work. Responses times and corrective actions shall be coordinated with the Government. In accordance with FAR 52.246-21 Warranty of Construction:

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under each task order conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of 1 year from the date of final acceptance of the work in each task order. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of-

(1) The Contractor's failure to conform to contract requirements; or
(2) Any defect of equipment, material, workmanship, or design furnished.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

e. The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government

shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall-

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

h. This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2007) Standard for Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2009) Standard for Safeguarding Construction,Alteration, and Demolition Operations
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation. Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

Backflow preventers; G

Construction Site Plan; G

SD-02 Shop Drawings

Traffic control plan; G

SD-06 Test Reports

Backflow Preventer Tests; G

SD-07 Certificates

Backflow Tester Certification; G

Backflow Preventers Certificate of Full Approval

1.4 TEMPORARY UTILITIES

1.4.1 Description of Work

Furnish, install and maintain temporary utilities required for construction. Remove on completion of work.

1.4.1.1 Requirements of Regulatory Agencies

Comply with:

a. National Electrical Code.

b. Federal, State and local codes and regulations.

c. FLETC Utility requirements

1.4.2 Materials

May be new or used, but must be adequate in capacity for the required usage. Must not create unsafe conditions. Must not violate requirements of applicable codes and standards.

1.4.2.1 Temporary Electricity

Temporary power will be extended from Government's existing power system. The Contractor will make all extensions and bear all related costs including the temporary pole and its placement. The temporary pole placement must be coordinated with Georgia Power and the Government. If the Contractor requires a temporary power drop from Georgia Power, he shall arrange for service and bear all related costs.

1.4.2.2 Temporary Telephone Service

Arrange with local telephone service company. Provide direct line telephone service at the construction site for the use of personnel and employees. Service required shall include one direct line instrument in field office and other instruments at the option of the Contractor. Pay all costs for installation, maintenance, and removal and service charges.

1.4.2.3 Temporary Water

Coordinate with the utility owner and make connections to the existing water system. The Contractor will obtain permits, pay for all temporary extensions and bear all related costs.

1.4.2.4 Temporary Toilet Facilities

Provide sanitary facilities in compliance with laws and regulations of the State of Georgia and County of Glynn. Service, clean, and maintain facilities and enclosures.

1.4.3 Installation

Comply with applicable requirements specified in Division 22 and 23 - Plumbing and Mechanical and in Division 26 - Electrical. Maintain and operate systems to ensure continuous service. Modify and extend service systems as work progress requires.

1.5 WEATHER PROTECTION

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

1.5.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

1.5.1.1 Hurricane Condition of Readiness

Unless directed otherwise, comply with:

a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards. Contact COTR for Condition Requirements.

b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment.Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness. Contact COTR for weather and COR updates and completion of required actions.

c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours):Curtail or cease routine activities until securing operation is complete.Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact COTR for weather and Condition of Readiness (COR) updates and completion of required actions.

d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

1.6 STATION OPERATION AFFECT ON CONTRACTOR OPERATIONS

1.6.1 Restricted Access Areas

The Government will monitor work in areas indicated. Notify Contracting Officer at least 14 calendar days prior to starting work in these areas.

1.6.2 Special Restrictions Regarding Access of Vehicles and Parking

1.6.2.1 Interruption of Vehicular Traffic

If during the performance of work, it becomes necessary to modify vehicular traffic patterns at any locations, notify the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan shall be in accordance with State and local regulations. Provide cones, signs, barricades, lights, signal men, or other traffic control devices and personnel required to control traffic. During construction, all traffic interruptions must be scheduled to minimize affects on staff and students. To minimize interruptions to staff and students, at the discretion of the Government, the closures may be required to occur during nonworking hours and/or weekends. Overtime and/or weekend work shall be at the expense of the Contractor.

1.7 STORAGE AREAS

Contractor shall be responsible for security of his property. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

1.7.1 Storage Size and Location

The open site available for storage shall be as indicated.

1.7.2 Storage in Existing Buildings

The Contractor shall be working around existing buildings; the storage of material will be allowed where indicated. Provide 8 foot high security fence with a lockable gate around the storage area. Remove at the completion of work and return existing facilities to their original condition.

1.8 TEMPORARY SANITARY FACILITIES

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required and approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance. Coordinate with the utility provider as required and dispose of sewage through connection to a municipal, district, or station sanitary sewage system. Bear all related costs of sanitary connections and facilities. Where such systems are not available, use chemical toilets or comparably effective units, and

periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Include provisions for pest control and elimination of odors.

1.9 TEMPORARY BUILDINGS

Temporary facilities (including trailers) shall be in like new condition. Locate these facilities where directed and within the indicated operations area. Storage of material/debris under such facilities is prohibited. Contractor shall be responsible for the security of the stored property.

1.9.1 Trailers or Storage Buildings

Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Government.The trailers or buildings shall be in good condition, free from visible damage rust and deterioration, and meet all applicable safety requirements. Trailers shall be roadworthy and comply with all appropriate state and local vehicle requirements. Failure to maintain storage trailers or buildings to these standards shall result in the removal of non-complying units at the Contractor's expense. A sign not smaller than 24 by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state of local standards for anchoring mobile trailers.

PART 2 PRODUCTS

2.1 BACKFLOW PREVENTERS

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound flanged cast iron, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. Approved backflow preventers shall be installed at all temporary connections to public fire hydrants.

PART 3 EXECUTION

3.1 TEMPORARY PHYSICAL CONTROLS

3.1.1 Access Controls

3.1.1.1 Temporary Barricades

Contractor shall provide for barricading around all work areas to prevent public access.

3.1.1.2 Fencing

The fencing shall be chain link and be 8 feet in height and be placed around the perimeter of the construction site and laydown area, and likewise a plastic silt fence shall be placed around construction site and laydown area. Fencing shall be provided along the construction site at all open excavations and tunnels controlling access to unauthorized people.

Fencing must be installed to be able to restrain a force of at least 200 pounds against it.

In addition, prior to the start of work, enclose those areas at the construction site which are not within the construction fence with a temporary safety fence, including gates and warning signs, to protect the public from construction activities. The safety fence shall be made of high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on minimum 10 foot centers. Remove the fence from the work site and restore to original condition upon completion of the contract.

3.1.1.3 Safety Signs

Place warning signs at the construction area perimeter designating the presence of construction hazards requiring unauthorized persons to keep out. Signs must be placed on all sides of the project, with at least one sign every 300 feet. All points of entry shall have signs designating the construction site as a hard hat area. Erect signs upon start of construction work.

3.2 TEMPORARY WIRING

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Program shall include frequent inspection of all equipment and apparatus.

3.3 CONSTRUCTION SIGN

Provide a 4 feet by 8 feet marine grade plywood project construction sign as described by the drawings in this section. Include project information on the sign and locate the sign as instructed by the PM. Erect project sign within 15 days of Notice to Proceed. Remove and dispose upon project completion.

-- End of Section --

SECTION 01 52 50

SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Requirements of this Section apply to, and are component of, each section of the specifications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.14	(1991) Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.94	Ventilation
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.502(f)	Warning Line Systems

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	(2003) Safety and Health Requirements Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2004) Safeguarding Construction,Alteration, and Demolition Operations

1.3 DEFINITIONS

a. Multi-employer work site (MEWS). The prime contractor is the "controlling authority" for all work site safety and health of the subcontractors.

b. Recordable Occupational Injuries or Illness. An occupational injury or illnesses which result in serious injuries, lost workday cases, non-fatal cases or significant mishaps.

c. Serious Injuries & Fatalities. Regardless of the time between the injury and death or the length of the illness; hospitalization of three or more employees; or property damage in excess of $200,000.

d. Lost Workday Cases. Injuries, other than fatalities, that result in lost workdays.

e. Non-Fatal Cases. Cases without lost workdays which result in transfer to another job or termination of employment, or require medical treatment (other than first aid) or involve property damage in excess of $10,000 but less than $200,000 or involve: loss of consciousness or restriction of work or motion. This category also includes any diagnosed occupational illnesses which are reported to the employer but are not classified as facilities or lost workday cases.

f. Health and Safety Plan. Army term of SHP or SSHP used in COE EM-385-1-1. "USACE" property and equipment specified in COE EM-385-1-1 should be interpreted as Government property and equipment.

g. Safety Officer. The superintendent or other qualified or competent person who is responsible for the on-site safety required for the project. The Contractor Quality Control Manager cannot be the safety officer, even through the QC has safety inspection responsibilities as part of the QC duties.

h. Significant Contractor Mishap. A contractor mishap which involves falls of 4 feet or more, electrical mishaps, confined space mishaps, diving mishaps, equipment mishaps, and fire mishaps which result in a lost time injury, or property damage of $10,000 or more, but less than $200,000; or when fire department or emergency medical treatment (EMT) assistance is required.

i. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment provided by a physician or registered personnel.

j. First Aid. A one-time treatment, and follow-up visit for the purpose of observation, of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care, even though provided by a physician or registered professional personnel.

k. Lost Workdays. The number of days (consecutive or not) after, but not including, the day of injury or illness during which the employee would have worked but could not do so; that is, could not perform all or part of his normal assignment during all or any part of the workday or shift; because of the occupational injury or illness.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00, "Submittal Procedures."

SD-07 Certificates

Accident prevention plan (APP);

Health and Safety Plan;

The above must be submitted a minimum of 7 days prior to scheduled Preconstruction Conference. Government approval is required prior to Notice to Proceed and commencement of construction work activities.

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

a. Qualifications of Safety Officer:

(1) Ability to manage the on-site contractor safety program through appropriate management controls,

(2) Ability to identify hazards and have the capability to expend resources necessary to abate the hazards.

(3) Must have worked on similar types of projects that are equal to or exceed the scope of the project assigned with the same responsibilities.

b. Qualification of Crane Operators. Crane operators shall meet the requirements in COE EM-385-1-1, Appendix G.

1.5.2 Meetings

1.5.2.1 Preconstruction Conference

The safety officer shall attend the preconstruction conference and routine progress meetings.

1.5.2.2 Meeting on Work Procedures

Meet with employees regularly to discuss work procedures and safety precautions required by the APP and AHA. Ensure the participation of the Contractor's PM, Superintendent and the Quality Control Manager.

1.6 ACCIDENT PREVENTION PLAN (APP)

Prepare the APP in accordance with the required and advisory provisions of COE EM-385-1-1 including Appendix A, "Minimum Basic Outline for Preparation of Accident Prevention Plan," and as modified herein. Include the associated AHA and other specific plans, programs and procedures listed on Pages A-3 and A-4 of COE EM-385-1-1, some of which are called out below. On-site work shall not be authorized until the Government has approved the APP.

1.6.1 Contents of the Accident Prevention Plan

a. Name and safety related qualifications of Safety Officer (including training and any certifications).

b. Qualifications of competent and of qualified persons including competent person for excavation.

c. Identify of the individual who will complete exposure data (hours worked); accident investigations, reports and logs; and immediate notification of accidents to include subcontractors.

d. Emergency response plan. Conform to COE EM-385-1-1, paragraph 01.E and include a map denoting the route to the nearest emergency care facility with emergency phone numbers. Contractor may be required to demonstrate emergency response.

e. Hazardous Material Use. Provisions to deal with hazardous materials, pursuant to the Contract Clause "FAR 52.223-3, Hazardous Material Identification and Material Safety Data." And the following:

(1) Inventory of hazardous materials to be introduced to the site with estimated quantities.

(2) Plan for protecting personnel and property during the transport, storage and use of the materials

(3) Emergency procedures for spill response and disposal, including a site map with approximate quantities on site at any given time. The site map will be attached to the inventory, showing where the hazardous substances are stored

(4) Safety Data Sheets for inventoried materials not required in other section of this specification.

(5) Labeling system to identify contents on all containers on-site.

(6) Plan for communicating high health hazards to employees and adjacent occupants.

f. Hazardous Energy Control Plan. For hazardous energy sources, comply with COE EM-385-1-1, paragraph 12.A.07.

g. Critical Lift Procedures. Weight handling critical lift plans will be prepared and signed in accordance with COE EM-385-1-1, paragraph 16.c.18.

h. Alcohol and Drug Abuse Plan. Description of the on-site prevention program.

i. Fall Protection Plan. The plan shall be site specific and protect all workers at elevations above 6 feet.

j. Silica Exposure Reduction. The plan shall include specific procedures to prevent employee silica inhalation exposures.

k. Excavation Plan. The safety and health aspects prepared in accordance with Section 02302, "Excavation, Backfilling, and Compacting for Utilities"

1.7 ACTIVITY HAZARD ANALYSIS (AHA)

Prepare for each task order. As a minimum, define activity being performed, sequence of work, specific hazards anticipated, control measures to eliminate or reduce each hazard to acceptable levels, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall arrest systems. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include excavation safeguarding requirements. The appropriate AHA shall be reviewed and attendance documented by Contractor at the preparatory, initial, and follow-up phases of Quality Control inspection.

1.8 HEALTH AND SAFETY PLAN (HASP)

Prepare as required by 29 CFR 1910.120 and COE EM-385-1-1.

1.8.1 Contents

a. Location, size, and details of control areas.

b. Location and details of decontamination systems.

c. Interface of trades involved in the construction.

d. Sequencing of work.

e. Disposal plan.

f. Sampling protocols.

g. Testing labs.

h. Protective equipment.

i. Pollution control.

j. Evidence of compliance with 29 CFR 1910.120 and 29 CFR 1926.65.

k. Training and certifications of CIH, CSP or other competent persons.

1.9 FALL HAZARD PREVENTION PROGRAM

1.9.1 Scaffolds

Delineate the fall protection requirements necessary during the erection and dismantling operation of scaffolds used on the project in the fall protection plan and activity hazard analysis for the phase of work.

1.9.2 Training

Institute a fall protection program. As part of the Fall Protection Program, contractor shall provide training for each employee who might be exposed to fall hazards.

1.10 DUTIES OF THE SAFETY OFFICER

a. Actively participate in the development of the required safety plan submittals.

b. Monitor and ensure construction hazards are identified and corrected.

c. Maintain applicable safety reference material, including COE EM-385-1-1, on the job site.

d. Maintain a log of safety inspections performed. Report all observed safety violations and corrective actions in writing to the Government.

e. Immediately stop any work activity in the event unsafe work practices are observed which are believed to pose a serious risk to personnel safety or property.

f. Attend the pre-construction conference and routine progress meetings.

g. Provide regular safety related training and instruction to all employees performing work under this contract.

1.11 DISPLAY OF SAFETY INFORMATION

Display the following information in clear view of the on-site construction personnel:

a. Map denoting the route to the nearest emergency care facility with emergency phone numbers.

b. AHA

c. Confined space entry permit.

d. Sign with number of hours worked since last lost workday accident.

1.12 SITE SAFETY PREFERENCE MATERIALS

Maintain safety-related references applicable to the project on site, including COE EM-385-1-1 and those others listed in the article "References." Maintain applicable equipment manufacturers' manuals.

1.13 HIGH HAZARD WORK AND LONG DURATION

Work under this contract is potentially hazardous. Pursuant to contract clause "FAR 52.236-13, Accident Prevention, Alternate I," submit in writing additional proposals for effecting accident prevention under hazardous conditions.

1.14 SITE CONDITIONS

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide.

1.15 REPORTS

1.15.1 Reporting Reports

For OSHA inspections or recordable accidents, the prime contractor will conduct a suitable investigation, provide a copy of the OSHA inspection or accident report to the Government, and identify corrective actions. Provide findings and reports to the Government within 5 calendar days of the inspection or accident.

1.15.2 Notification

Notify the Contracting Officer, within 4 hours, of any accident meeting the definition of OSHA recordable occupational injury or illness. Information shall include Contractor name; contract title; type of contract; name of activity, installation or location where mishap occurred; date and time of mishap; names of personnel injured; extent of property damage, if any; and brief description of mishap (to include type of construction equipment used, PPE used, etc.) In addition to OSHA reporting requirements, initial notification shall be made of any accident involving significant mishaps.

1.15.3 OSHA Citations and Violations

Provide the PM and Contracting Officer with a copy of each OSHA citation, OSHA report and Contractor response. Correct violations and citations promptly and provide written corrective actions to the Government.

PART 2 PRODUCTS

2.1 FALL PROTECTION ANCHORAGE

Fall protection anchorages, used by contractors to protect their people, will be left in place and so identified for continued customer use.

PART 3 EXECUTION

3.1 CONSTRUCTION

Comply with COE EM-385-1-1, NFPA 241, the accident prevention plan, the activity hazard analysis and other related submittals and activity fire and safety regulations.

3.1.1 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited.

3.1.2 Unforeseen Hazardous Material

The task order should have identified materials such as PCB, lead paint, and friable and nonfriable asbestos. If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer, ConRep and COR immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or

poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages a minimum of 15 days in advance. As a minimum, the request should include the location of the outage, utilities being effected, duration of outage and any necessary sketches. Once approved and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Construction Representative to review the scope of work and the lock out/tag out procedures for worker protection.

3.3 PERSONNEL PROTECTION

3.3.1 Hazardous Noise

Provide hazardous noise signs, and hearing protection, where ever equipment and work procedures produce sound-pressure levels greater than 85 dBA steady state or 140 dBA impulse, regardless of the duration of the exposure.

3.3.2 Fall Protection

Enforce use of the fall protection device named for each activity in the AHA all times when an employee is on a surface 6 feet or more above lower levels. Personal fall arrest systems are required when working from an articulating or extendible boom, scissor lifts, swing stages, or suspended platform. Fall protection must comply with ANSI A10.14.

3.3.2.1 Personal Fall Arrest Device

Equipment, subsystems, and components shall meet ANSI Z359.1, Personal Fall Arrest Systems. Only an full-body harness with a shock absorbing lanyard is an acceptable personal fall arrest device. Body belts may only be used as positioning devices only such as for steel reinforcing assembly. Body belts are not authorized as a personal fall arrest device. Harnesses must have upper middle back "D" rings for proper body suspension during a fall. Lanyard must be fitted with a double locking snap hook attachment. Webbing, straps, and ropes must be of synthetic fiber or wire rope.

3.3.2.2 Fall Protection for Roofs

a. For work within 6 feet of an edge, on low pitched roofs, personnel shall be protected by use of personal fall arrest systems, guardrails, safety nets. Safety monitoring system is not adequate fall protection and is not authorized.

b. For work greater than 6 feet from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.502(f).

c. Work on steep roofs requires personal fall arrest, guardrails with toeboards, or safety nets. This requirement includes residential or housing type construction.

3.3.2.3 Safety Nets

Safety nets shall be provided in unguarded workplaces over water, machinery, dangerous operations, or more than 25 feet above surface.

3.3.3 Scaffolding

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Contractor shall ensure that scaffold erection is performed by employees that are qualified. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection plan. Minimum platform size shall be based on the platform not being greater in height than four times the dimension of the smallest width dimension for rolling scaffold. Some Baker type scaffolding has been found not to meet these requirements. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. The first tie-in shall be at the height equal to 4 times the width of the scaffold base.

3.3.4 Use of Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufactures printed operating instructions. Crane supported work platforms shall only be used in extreme conditions if the Contractor proves that using any other access to the work location would provide a greater hazard to the workers.

b. Cranes must be equipped with Load Indicating Devices, anti-two blocks devices, load, boom angle moment indicating indicators.

c. Christmas-tree lifting (multiple rigged materials) is not allowed.

3.3.5 Excavations

The Safety Officer shall be on site when work is being performed in excavation, and shall inspect excavations prior to entry by workers. Individual must evaluate for all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

3.3.6 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cable intended to be cut must be positively identified and de-energized prior to performing each cut. Perform all high voltage cutting remotely. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high

voltage personnel must use personnel protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor AHA.

3.3.7 Crystalline Silica

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and COE EM-385-1-1, (Appendix C). The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.4 ACCIDENT SCENE PRESERVATION

For serious accidents, ensure the accident site is secured and evidence is protected remaining undisturbed until released by the Contracting Officer.

3.5 FIELD QUALITY CONTROL

3.5.1 Inspection

Include safety inspection as a part of the daily Quality Control inspections required in Section 01 45 00, "Quality Control."

-- End of Section --

SECTION 01 57 19.00 20

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004	(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)
EPA 833-R-060-04	(2000) Developing Your Storm Water Pollution Prevention Plan, a Guide for Construction Sites

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 271	Requirements for Authorization of State Hazardous Waste Programs
40 CFR 272	Approved State Hazardous Waste Management Programs
40 CFR 273	Standards For Universal Waste Management
40 CFR 279	Standards for the Management of Used Oil
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 355	Emergency Planning and Notification
40 CFR 372-SUBPART D	Specific Toxic Chemical Listings
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Garbage, refuse, debris, sludge, or other discharged material, including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations. Types of solid waste typically generated at construction sites may include:

a. Green waste: The vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

b. Surplus soil: Existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included.

c. Debris: Non-hazardous solid material generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

d. Wood: Dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated and/or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included.

e. Scrap metal: Scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

f. Paint cans: Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.

g. Recyclables: Materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company. Paint cans may be included as recyclable if sold to a scrap metal company.

h. Hazardous Waste: By definition, to be a hazardous waste a material must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste.They have

additional regulatory controls and must be handled separately. They are thus defined separately in this document.

Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.3 Hazardous Debris

As defined in Solid Waste paragraph, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) per 40 CFR 261; or debris that exhibits a characteristic of hazardous waste per 40 CFR 261.

1.2.4 Chemical Wastes

This includes salts, acids, alkalizes, herbicides, pesticides, and organic chemicals.

1.2.5 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.6 Hazardous Waste

Any discarded material, liquid, solid, or gas, which meets the definition of hazardous material or is designated hazardous waste by the Environmental Protection Agency or State Hazardous Control Authority as defined in 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 271, 40 CFR 272, 40 CFR 273, 40 CFR 279, and 40 CFR 280.

1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that:

a. Is regulated as a hazardous material per 49 CFR 173, or

b. Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.120, or

c. During end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical

waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.8 Waste Hazardous Material (WHM)

Any waste material which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial hazard to human health or the environment and which has been so designated. Used oil not containing any hazardous waste, as defined above, falls under this definition.

1.2.9 Oily Waste

Those materials which are, or were, mixed with used oil and have become separated from that used oil. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, used oil and may be appropriately tested and discarded in a manner which is in compliance with other State and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that:

a. It is not prohibited in other State regulations or local ordinances

b. The amount generated is "de minimus" (a small amount)

c. It is the result of minor leaks or spills resulting from normal process operations

d. All free-flowing oil has been removed to the practical extent possible

Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, a hazardous waste determination must be performed prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.10 Regulated Waste

Those solid waste that have specific additional Federal, state, or local controls for handling, storage, or disposal.

1.2.11 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

chlorofluorocarbon-11 (CFC-11)
chlorofluorocarbon-12 (CFC-12)
chlorofluorocarbon-13 (CFC-13)
chlorofluorocarbon-111 (CFC-111)

chlorofluorocarbon-112 (CFC-112)
chlorofluorocarbon-113 (CFC-113)
chlorofluorocarbon-114 (CFC-114)
chlorofluorocarbon-115 (CFC-115)
chlorofluorocarbon-211 (CFC-211)
chlorofluorocarbon-212 (CFC-212)
chlorofluorocarbon-213 (CFC-213)
chlorofluorocarbon-214 (CFC-214)
chlorofluorocarbon-215 (CFC-215)
chlorofluorocarbon-216 (CFC-216)
chlorofluorocarbon-217 (CFC-217)
chlorofluorocarbon-500 (CFC-500)
chlorofluorocarbon-502 (CFC-502)
chlorofluorocarbon-503 (CFC-503)
halon-1211
halon-1301
halon-2402
carbon tetrachloride
methyl bromide
methyl chloroform

Class II ODS is defined in Section 602(s) of The Clean Air Act and includes the following chemicals:

hydrochlorofluorocarbon-21 (HCFC-21)
hydrochlorofluorocarbon-22 (HCFC-22)
hydrochlorofluorocarbon-31 (HCFC-31)
hydrochlorofluorocarbon-121 (HCFC-121)
hydrochlorofluorocarbon-122 (HCFC-122)
hydrochlorofluorocarbon-123 (HCFC-123)
hydrochlorofluorocarbon-124 (HCFC-124)
hydrochlorofluorocarbon-131 (HCFC-131)
hydrochlorofluorocarbon-132 (HCFC-132)
hydrochlorofluorocarbon-133 (HCFC-133)
hydrochlorofluorocarbon-141 (HCFC-141)
hydrochlorofluorocarbon-142 (HCFC-142)
hydrochlorofluorocarbon-221 (HCFC-221)
hydrochlorofluorocarbon-222 (HCFC-222)
hydrochlorofluorocarbon-223 (HCFC-223)
hydrochlorofluorocarbon-224 (HCFC-224)
hydrochlorofluorocarbon-225 (HCFC-225)
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hydrochlorofluorocarbon-251 (HCFC-251)
hydrochlorofluorocarbon-252 (HCFC-252)
hydrochlorofluorocarbon-253 (HCFC-253)
hydrochlorofluorocarbon-261 (HCFC-261)
hydrochlorofluorocarbon-262 (HCFC-262)
hydrochlorofluorocarbon-271 (HCFC-271)

1.2.11.1 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (e.g., thermostats) and lamps (e.g., fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey;

Solid Waste Management Plan and Permit;

Regulatory Notifications;

Environmental Management Plan;

Storm Water Pollution Prevention Plan;

Storm Water Notice of Intent (for NPDES coverage under the general permit for construction activities);

Dirt and Dust Control Plan

Contractor Hazardous Material Inventory Log;

SD-06 Test Reports

Laboratory Analysis

Disposal Requirements

Erosion and Sediment Control Inspection Reports

Storm Water Inspection Reports for General Permit

Contractor 40 CFR employee training records Solid

Waste Management Report;

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with

Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

The Contractor may be required to promptly conduct tests and procedures for the purpose of assessing whether construction operations are in compliance with Applicable Environmental Laws. Analytical work shall be done by qualified laboratories; and where required by law, the laboratories shall be certified.

1.4.1 Environmental Compliance Assessment Training and Tracking System (ECATTS)

The Superintendent is responsible for environmental compliance on task orders unless an Environmental Manager is named. The Superintendent (and alternative Superintendent) or Environmental Manager shall complete ECATTS training prior to starting respective portions of on-site work under this contract. If personnel changes occur for any of these positions after starting work, replacement personnel shall complete ECATTS training within 14 days of assignment to the contract.

Submit an ECATTS certificate of completion for personnel who have completed the required "Environmental Compliance Assessment Training and Tracking System (ECATTS)" training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

This training has been structured to allow contractor personnel to receive credit under this contract and also to carry forward credit to future contracts. Contractors shall ensure that the QC Manager (and alternate QC Manager) or Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific State regulatory requirements; therefore, Contractors working in multiple states will be requires to re-take modules tailored to the state where the contract work is being performed.

ECATTS is available for use by all contractor and subcontractor personnel associated with this project. These other personnel are encouraged (but not required) to take the training and may do so at their discretion.

1.4.2 Conformance with the Environmental Management System

The Contractor shall perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to objectives and targets, environmental programs and operational controls identified by the EMS. The Contractor will provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, the Contractor shall take corrective and/or preventative actions. In addition, the Contractor shall ensure that its employees are aware of their roles and responsibilities under the EMS and how these EMS roles and responsibilities affect work performed under the contract.

The Contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and keep up to date on regulatory required specific training for the type of work to be conducted onsite. All on-site Contractor personnel, and their subcontractor personnel, performing tasks that have the potential to cause a significant environmental impact shall be competent on the basis of appropriate education, training or experience. Upon contract award, the Contracting Officer's Representative will notify the installation's EMS coordinator to arrange EMS training. The installation's EMS coordinator shall identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. The Contractor shall provide training documentation to the Contracting Officer. The EMS coordinator shall retain associated records.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey

Perform a Preconstruction Survey of task order sites, and take photographs showing existing environmental conditions in and adjacent to the site.

1.5.2 Regulatory Notifications

The Contractor is responsible for all regulatory notification requirements in accordance with Federal, State and local regulations. The Contractor shall submit copies of all regulatory notifications to the Contracting Officer prior to commencement of work activities.

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting.

Prior to initiating any work on site, meet with the PM to develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, required permits, permit requirements, and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager will be directly responsible for coordinating contractor compliance with Federal, State, local, and station requirements. The Environmental Manager will ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the Environmental Management Plan; ensure that all environmental permits are obtained, maintained, and closed out; ensure compliance with Storm Water Program Management requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral duty of the Superintendent; however the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure all Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder

and required documentation, including environmental permits compliance and close-out.

1.5.5 Contractor 40 CFR Employee Training Records

Prepare and maintain employee training records throughout the term of the contract meeting applicable 40 CFR requirements. The Contractor will ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with Federal, State and local regulatory requirements for RCRA Large Quantity Generator. The Contractor will provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ENVIRONMENTAL MANAGEMENT PLAN

Prior to initiating any work on site, the Contractor will meet with the Contracting Officer to discuss the proposed Environmental Protection Plan and develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. The Contractor's Environmental Plan shall incorporate construction related objectives and targets from the installation's Environmental Management System. The Environmental Management Plan will be submitted in the following format and shall include the elements specified below.

a.Description of the Environmental Management Plan

(1) General overview and purpose

(a) A brief description of each specific plan required by environmental permit or elsewhere in this contract.

(b) The duties and level of authority assigned to the person(s) on the job site that oversee environmental compliance.

(c) A copy of any standard or project specific operating procedures that will be used to effectively manage and protect the environment on the project site.

(d) Communication and training procedures that will be used to convey environmental management requirements to contractor employees and subcontractors.

(e) Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

(2) General site information

(3) A letter signed by an officer of the firm appointing the Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract.

b. Management of Natural Resources

(1) Land resources

(2) Tree protection

(3) Replacement of damaged landscape features

(4) Temporary construction

(5) Stream crossings

(6) Fish and wildlife resources

(7) Wetland areas

c. Protection of Historical and Archaeological Resources

(1) Objectives

(2) Methods

d. Storm Water Management and Control

(1) Ground cover

(2) Erodible soils

(3) Temporary measures

(a) Mechanical retardation and control of runoff

(b) Vegetation and mulch

(4) Effective selection, implementation and maintenance of Best Management Practices (BMPs).

e. Protection of the Environment from Waste Derived from Contractor Operations

(1) Control and disposal of solid and sanitary waste.

(2) Control and disposal of hazardous waste (Hazardous Waste Management Section)

This item will consist of the management procedures for all hazardous waste to be generated. The elements of those procedures will coincide with the Activity Hazardous Waste Management Plan. A copy of the Activity Hazardous Waste Management Plan will be provided by the Contracting Officer. As a minimum, include the following:

(a) Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated;

(b) Sampling/analysis plan;

(c) Methods of hazardous waste accumulation/storage (i.e., in tanks and/or containers);

(d) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted);

(e) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268);

(f) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and the like;

(g) Used oil management procedures in accordance with 40 CFR 279;

(h) Pollution prevention\hazardous waste minimization procedures;

(i) Plans for the disposal of hazardous waste by permitted facilities;

(j) Procedures to be employed to ensure all required employee training records are maintained.

f. Prevention of Releases to the Environment

(1) Procedures to prevent releases to the environment

(2) Notifications in the event of a release to the environment

g. Regulatory Notification and Permits

List what notifications and permit applications must be made. Demonstrate that those permits have been obtained by including copies of all applicable, environmental permits.

3.1.1 Environmental Protection Plan Review

Within thirty days after the Contract award date, submit the proposed Environmental Management Plan for further discussion, review, and approval. Commencement of work will not begin until the environmental management plan has been approved.

3.1.2 Licenses and Permits

Obtain licenses and permits pursuant to the "Permits and Responsibilities" FAR Clause 52.236-7.

No permits will be obtained by the Contracting Officer.

3.2 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. If the work is near streams, lakes, or other waterways, conform to the national permitting requirements of the Clean Water Act.

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor will be responsible for any resultant damage.

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

3.2.1 Erosion and Sediment Control Measures

3.2.1.1 Burnoff

Burnoff of the ground cover is not permitted.

3.2.1.2 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.2.1.3 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

a. Mechanical Retardation and Control of Runoff

Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.

b. Sediment Basins

(1) Trap sediment in temporary sediment basins. Select a basin size to accommodate the runoff of a local 5-year storm. Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs.

(2) Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare BMP Inspection Reports as required by the general permit. If required by the permit, include those inspection reports.

c. Vegetation and Mulch

(1) Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

(2) Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish or reestablish a suitable stand of grass. The seeding operation will be as specified in Section 32 92 19 SEEDING.

3.2.2 Erosion and Sediment Control Inspection Reports

Submit "Erosion and Sediment Control Inspection Reports" (E&S) (form provided at the pre-construction conference) and Storm Water Inspection Reports for General Permit for General Permit to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch or more of rain.

Note erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports if applicable.

3.2.2.1 Storm Water Notice of Intent for Construction Activities and Storm Water Pollution Prevention Plan

The Contractor shall submit a Storm Water Notice of Intent (for NPDES coverage under the general permit for construction activities) and a Storm Water Pollution Prevention Plan (SWPPP) for the contract to the Contracting Officer prior and gain approval prior to the commencement of work. The SWPPP will meet the requirements of the EPA or State general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate Federal or State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. The Contractor shall maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, reflecting current site conditions.

Coverage under this permit requires the contractor prepare a Storm Water Pollution Prevention Plan (SWPPP), prepare and submit a Registration

Statement as a co-permittee with the CO, and provide the permit fee to the responsible state agency before any land disturbing activities begin. The contractor shall file for permit coverage on behalf CO and himself and file a Notice of Termination once construction is complete and the site is stabilized with a final sustainable cover.

Under the terms and conditions of the permit, the Contractor may be required to install, inspect, maintain best management practices (BMPs), and submit stormwater BMP inspection reports and stormwater pollution prevention plan inspection reports. The Contractor shall ensure construction operations and management are constantly in compliance with the terms and conditions of the general permit for storm water discharges from construction activities.

a. The SWPPP shall:

(1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

(2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

(3) Ensure compliance with terms of the EPA or State general permit for storm water discharge.

(4) Select applicable best management practices from EPA 833-R-060-04.

(5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

(6) Storm Water Pollution Prevention Measures and Notice of Intent 40 CFR 122.26, EPA 833-R-060-04. Provide a "Storm Water Pollution Prevention Plan" (SWPPP) for the project. The SWPPP will meet the requirements of the EPA or State general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate Federal or State agency for approval, a minimum of 14 calendar days prior to the start of construction. A copy of the approved SWPPP will be kept at the construction on-site office, and continually updated as regulations require reflecting current site conditions.

3.2.2.2 Storm Water Pollution Prevention Plan Compliance Notebook

The contractor shall create and maintain a binder of documents that demonstrate compliance with the Stormwater Construction Activity permit.

3.2.3 Stormwater Drainage and Construction Dewatering

There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to the river without prior specific authorization of the Environmental Division in writing. Discharge of hazardous substances will not be permitted under any circumstances.

Construction site runoff will be prevented from entering any storm drain or the river directly by the use of straw bales or other method suitable to the Environmental Division. Contractor will provide erosion protection of the surrounding soils.

Construction Dewatering shall not be discharged to the sanitary sewer. If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Authorization for any contaminated groundwater release shall be obtained in advance from the base Environmental Officer. Discharge of hazardous substances will not be permitted under any circumstances.

3.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Upon discovery, notify the Contracting Officer. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.4 SOLID WASTE MANAGEMENT PLAN AND PERMIT

Provide to the contracting officer written notification of the quantity of solid waste/debris that is anticipated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance or as applicable, submit one copy of a State and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

3.4.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

The Contractor will include copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, the Contractor may submit a statement indicating the disposal location for the solid waste which is signed by an officer of the Contractor firm authorized to legally obligate or bind the firm. The sales documentation or Contractor certification will include the receiver's tax identification number and business, EPA or State registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained by the Contractor for his own use, the Contractor will submit on the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.4.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged and can be coordinated with the Contracting Officer and the activity recycling coordinator. Remove all solid waste (including non-hazardous debris) from Government property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage spent hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, as per environmental law.

3.4.2.1 Dumpsters

Equip dumpsters with a secure cover and paint the standard base color. Keep cover closed at all times, except when being loaded with trash and debris. Empty site dumpsters as needed to keep the site free of debris and trash. For large demolitions, large dumpsters without lids are acceptable but should not have debris higher than the sides before emptying.

3.5 WASTE DETERMINATION DOCUMENTATION

Complete a Waste Determination form (provided at the pre-construction conference) for all contractor derived wastes to be generated. Base the waste determination upon either a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated, EPA approved analytical data, or laboratory analysis (Material Safety Data Sheets (MSDS) by themselves are not adequate). Attach all support documentation to the Waste Determination form. As a minimum, a Waste Determination form must be provided for the following wastes (this listing is not all inclusive): oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and all containers of the original materials.

3.6 CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG

Submit the "Contractor Hazardous Material Inventory Log"(found at: http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.6.1 Disposal Documentation for Hazardous and Regulated Waste

Manifest, pack, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of construction in accordance with the generating facilities generator status under the Recourse Conservation and Recovery Act. Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or State permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifest must be reviewed, signed, and approved before the Contractor may ship waste. To obtain specific disposal instructions the Contractor must coordinate with the environmental office.

3.7 POLLUTION PREVENTION/HAZARDOUS WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of hazardous waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the Environmental Management Plan. Consult with the activity Environmental Office for suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for reference material when preparing this part of the plan. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the types of the hazardous materials expected to be used in the construction when requesting information.

3.8 WHM/HW MATERIALS PROHIBITION

No waste hazardous material or hazardous waste shall be disposed of on government property. No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract. The government is not responsible for disposal of Contractor's waste material brought on the job site and not required in the performance of this contract. The intent of this provision is to dispose of that waste identified as waste hazardous material/hazardous waste as defined herein that was generated as part of this contract and existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. Incidental materials used to support the contract including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive. The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or to the river or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

3.9 HAZARDOUS MATERIAL MANAGEMENT

No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract.

Include hazardous material control procedures in the Safety Plan. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Submit a MSDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on base. Typical materials requiring MSDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of

hazardous materials have NFPA labels or their equivalent. Keep copies of the MSDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project. Certify that all hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste per 40 CFR 261.

3.10 PETROLEUM PRODUCTS AND REFUELING

Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed of at Contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

3.10.1 Oily and Hazardous Substances

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

3.10.2 Inadvertent Discovery of Petroleum Contaminated Soil or Hazardous Wastes

If petroleum contaminated soil or suspected hazardous waste is found during construction that was not identified in the contract documents, the contractor shall immediately notify the contracting officer. The contractor shall not disturb this material until authorized by the contracting officer.

3.11 FUEL TANKS

Petroleum products and lubricants required to sustain up to 30 days of construction activity may be kept on site. Storage and refilling practices shall comply with 40 CFR Part 112. Secondary containment shall be provided and be no less than 110 percent of the tank volume plus five inches of free-board. If a secondary berm is used for containment then the berm shall be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Drips pans are required and the tanks must be covered during inclement weather.

3.12 RELEASES/SPILLS OF OIL AND HAZARDOUS SUBSTANCES

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Contracting Officer.

The Contractor is responsible for verbal and written notifications as required by the federal 40 CFR 355, State, local regulations and Homeland Security Instructions. Spill response will be in accordance with 40 CFR 300 and applicable State and local regulations. Contain and clean up these spills without cost to the Government. If Government assistance is requested or required, the Contractor will reimburse the Government for such assistance. Provide copies of the written notification and documentation that a verbal notification was made within 20 days.

Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous (WHM) waste spills. The Contractor shall reimburse the government for all material, equipment, and clothing generated during any spill cleanup. The Contractor shall reimburse the government for all costs incurred including sample analysis materials, equipment, and labor if the government must initiate its own spill cleanup procedures, for Contractor responsible spills, when:

a. The Contractor has not begun spill cleanup procedure within one hour of spill discovery/occurrence, or

b. If, in the government's judgment, the Contractor's spill cleanup is not adequately abating life threatening situation and/or is a threat to any body of water or environmentally sensitive areas.

3.13 CONTROL AND MANAGEMENT OF HAZARDOUS WASTES

3.13.1 Facility Hazardous Waste Generator Status

FLETC is designated as a Large Quantity Generator. All work conducted within the boundaries of this activity must meet the regulatory requirements of this generator designation. The Contractor will comply with all provisions of Federal, State and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of all construction derived wastes.

3.13.2 Hazardous Waste/Debris Management

Identify all construction activities which will generate hazardous waste/debris. Provide a documented waste determination for all resultant waste streams. Hazardous waste/debris will be identified, labeled, handled, stored, and disposed of in accordance with all Federal, State, and local regulations including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the Environmental Protection Plan. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government.

Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by activity personnel from the Environmental Office. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-

SUBPART D. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.13.2.1 Regulated Waste Storage/Satellite Accumulation/90 Day Storage Areas

If the work requires the temporary storage/collection of regulated or hazardous wastes, the Contractor will request the establishment of a Regulated Waste Storage Area, a Satellite Accumulation Area, or a 90 Day Storage Area at the point of generation. The Contractor must submit a request in writing to the Contracting Officer providing the following information:

Contract Number	_____	Contractor	_____
Haz/Waste or Regulated Waste POC	_____	Phone Number	_____
Type of Waste	_____	Source of Waste	_____
Emergency POC	_____	Phone Number	_____

Location of the Site: _____
(Attach Site Plan to the Request)

Attach a waste determination form. Allow ten working days for processing this request. The designated area where waste is being stored shall be barricaded and a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.13.2.2 Sampling and Analysis of HW

a. Waste Sampling

Sample waste in accordance with EPA 530/F-93/004. Each sampled drum or container will be clearly marked with the Contractor's identification number and cross referenced to the chemical analysis performed.

b. Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. The Contractor will provide all analytical results and reports performed to the Contracting Officer

c. Analysis Type

Identify waste hazardous material/hazardous waste by analyzing for the following properties as a minimum: ignitability, corrosiveness, total chlorides, BTU value, PCBs, TCLP for heavy metals, and cyanide.

3.13.2.3 Asbestos Certification

Items, components, or materials disturbed by or included in work under this contract do involve asbestos. Other materials in the general area around

where work will be performed may contain asbestos. All thermal insulation, in all work areas, should be considered to be asbestos unless positively identified by conspicuous tags or previous laboratory analysis certifying them as asbestos free.

Inadvertent discovery of non-disclosed asbestos that will result in an abatement action requires a change in scope before proceeding. Upon discovery of asbestos containing material not identified in the contract documents, the Contractor shall immediately stop all work that would generate further damage to the material, evacuate the asbestos exposed area, and notify the Contracting Officer for resolution of the situation prior to resuming normal work activities in the affected area. The Contractor will not remove or perform work on any asbestos containing materials without the prior approval of the Contracting Officer. The Contractor will not engage in any activity, which would remove or damage such materials or cause the generation of fibers from such materials.

Asbestos containing waste shall be managed and disposed of in accordance with applicable environmental law. Asbestos containing waste shall be manifested and the manifest provided to the Contracting Officer.

3.13.2.4 Hazardous Waste Disposal

No hazardous, toxic, or universal waste shall be disposed or hazardous material abandoned on government property. And unless otherwise noted in this contract, the government is not responsible for disposal of Contractor generated waste material. The disposal of incidental materials used to accomplish the work including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive.

The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or water way or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

Control of stored waste, packaging, sampling, analysis, and disposal will be determined by the details in the contract. The requirements for jobs in the following paragraphs will be used as the guidelines for disposal of any hazardous waste generated.

a. Responsibilities for Contractor's Disposal

Contractor responsibilities include any generation of WHM/HW requiring Contractor disposal of solid waste or liquid.

(1) The Contractor agrees to provide all service necessary for the final treatment/disposal of the hazardous material/waste in accordance with all local, State and Federal laws and regulations, and the terms and conditions of the contract within sixty (60) days after the materials have been generated. These services will include all necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal, and/or transportation, including manifesting or completing waste profile sheets, equipment, and the compilation of all documentation is required).

(2) Contain all waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 272, 40 CFR 273, 40 CFR 279, 40 CFR 280, and 40 CFR 761.

(3) Obtaining a representative sample of the material generated for each job done to provide waste stream determination.

(4) Analyzing for each sample taken and providing analytical results to the Contracting Officer. Provide two copies of the results.

(5) Determine the DOT proper shipping names for all waste (each container requiring disposal) and will demonstrate how this determination is developed and supported by the sampling and analysis requirements contained herein to the Contracting Officer.

Contractor Disposal Turn-In Requirements

For any waste hazardous materials or hazardous waste generated which requires the Contractor to dispose of, the following conditions must be complied with in order to be acceptable for disposal:

a. Drums compatible with waste contents and drums meet DOT requirements for 49 CFR 173 for transportation of materials.

b. Drums banded to wooden pallets. No more than three (3) 55 gallon drums to a pallet, or two (2) 85 gallon over packs.

c. Band using 1-1/4 inch minimum band on upper third of drum.

d. Recovery materials label (provided by Code 106.321) located in middle of drum, filled out to indicate actual volume of material, name of material manufacturer, other vendor information as available.

e. Always have three (3) to five (5) inches of empty space above volume of material. This space is called 'outage'.

3.13.3 Class I and II ODS Prohibition

Class I ODS as defined and identified herein will not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition will be considered to prevail over any other provision, specification, drawing, or referenced documents. Regulations related to the protection of stratosphere ozone may be found in 40 CFR 82.

Heating and air conditioning technicians must be certified through an EPA-approved program. Copies of certifications shall be maintained at the employees' place of business and be carried as a wallet card by the technician, as provided by environmental law. Accidental venting of a refrigerant is a release and shall be reported to the Contracting Officer.

3.13.3.1 Universal Waste/e-Waste Management

Universal waste including but not limited to some mercury containing building products such florescent lamps, mercury vapor lamps, high pressure sodium lamps, CRTs, batteries, aerosol paint containers, electrical equipment containing PCBs, and consumed electronic devices, shall be managed

in accordance with applicable environmental law and installation instructions.

3.14 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.14.1 Dirt and Dust Control Plan

Submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

3.15 ABRASIVE BLASTING

3.15.1 Blasting Operations

The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive, agent, paint chips, and other debris in accordance with the requirements specified. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.15.2 Disposal Requirements

Submit analytical results of the debris generated from abrasive blasting operations per paragraph entitled Laboratory Analysis of this section. Hazardous waste generated from blasting operations will be managed in accordance with paragraph entitled "Hazardous Waste\Debris Management" of this section and with the approved HWMP. Disposal of non-hazardous abrasive blasting debris will be in accordance with paragraph entitled, "Control and Disposal of Solid Wastes".

3.16 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated times.

3.17 MERCURY MATERIALS

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the Environmental Office and the

Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal.

-- End of Section --

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4439	(2004) Geosynthetics
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 SYSTEM DESCRIPTION

The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies in conformance with the requirements of the National Pollutant Discharge Elimination System (NPDES).

1.3 EROSION AND SEDIMENT CONTROLS

The controls and measures required of the Contractor are described below.

1.3.1 Stabilization Practices

The stabilization practices to be implemented include temporary seeding, mulching, geotextiles, and protection of trees. On the daily CQC Report, record the dates when the major grading activities occur, (e.g., clearing and grubbing, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS, initiate stabilization practices as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.3.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases or is precluded by unsuitable conditions caused by the weather, initiate stabilization practices as soon as practicable after conditions become suitable.

1.3.1.2 Burnoff

Burnoff of the ground cover is not permitted.

1.3.1.3 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified, and protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

1.3.2 Erosion, Sediment and Stormwater Control

a. Submit a Storm Water Notice of Intent for NPDES coverage under the general permit for construction activities and a Storm Water Pollution Prevention Plan (SWPPP) for the project to the Contracting Officer prior to the commencement of work. The SWPPP shall meet the requirements of the State of Georgia general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Contracting Officer, to the appropriate State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. Maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, toreflect current site conditions. Include within the SWPPP:

(1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

(2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

(3) Ensure compliance with terms of the State of Georgia general permit for storm water discharge.

(4) Select applicable best management practices from EPA 832-R-92-005.

(5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

1.3.3 Structural Practices

Implement structural practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement structural practices in a timely manner, during the construction process, to minimize erosion and sediment runoff. Include the following devices; Location and details of installation and construction are shown on the drawings.

1.3.3.1 Silt Fences

Provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Properly install silt fences to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Install silt fences in the locations indicated on the drawings. Obtain approval from the Contracting Officer prior to final removal of silt fence barriers.

1.3.4 Vegetation and Mulch

a. Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

b. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to reestablish a suitable stand of grass. The seeding operation will be as specified in Section 32 92 19 SEEDING.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Storm Water Pollution Prevention Plan

Storm Water Notice of Intent

Pollution prevention plan and Notice of intent for NPDES coverage under the general permit for construction activities

SD-06 Test Reports

Erosion and Sediment Controls

SD-07 Certificates

Mill Certificate or Affidavit

Certificate attesting that the Contractor has met all specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

Identify, store and handle filter fabric in accordance with ASTM D4873.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

Provide geotextile that complies with the requirements of ASTM D4439, and consists of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and contains stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Provide synthetic filter fabric that contains ultraviolet ray inhibitors and stabilizers to assure a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE		
PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile Elongation (percent)	ASTM D4632	445 N100 lbs. min. 30 percent max.
Trapezoid Tear	ASTM D4533	245 N min.55 lbs. min.
Permittivity	ASTM D4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D4751	20-100

2.1.2 Silt Fence Stakes and Posts

Use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 by 2 inches when oak is used and 4 by 4 inches when pine is used, and have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

Provide a mill certificate or affidavit attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. Specify in the mill certificate or affidavit the actual Minimum Average Roll Values and identify the fabric supplied by roll identification numbers. Submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Extend silt fences a minimum of 24 inches above the ground surface without exceeding 34 inches above the ground surface. Provide filter fabric from a

continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, splice together filter fabric at a support post, with a minimum 8 inch overlap, and securely sealed. Excavate trench approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Remove silt fences upon approval by the Contracting Officer.

3.2 FIELD QUALITY CONTROL

Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

3.2.1 Silt Fence Maintenance

Inspect the silt fences in accordance with paragraph, titled "Inspections," of this section. Any required repairs shall be made promptly. Pay close attention to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, replace the fabric promptly. Remove sediment deposits when deposits reach one-third of the height of the barrier. Remove a silt fence when it is no longer required. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall receive erosion control.

3.3 INSPECTIONS

3.3.1 General

Inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit a site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Conduct inspections at least once every month where sites have been finally stabilized.

3.3.2 Inspections Details

Inspect disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system. Observe erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan to ensure that they are operating correctly. Inspect discharge locations or points to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Inspect locations where vehicles exit the site for evidence of offsite sediment tracking.

3.3.3 Inspection Reports

For each inspection conducted, prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection,

the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. Furnish the report to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 1971	(2005) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2000; R 2009) Industrial and Institutional Cleaners

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08	(2009, with Change 1) Criteria for Transfer and Acceptance of DoD Real Property

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials
Warranty
Final Cleaning

SD-08 Manufacturer's Instructions

Preventative Maintenance
Inspection
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

Drawings showing final as-built conditions of the task order. This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions.

1.3.1.1 Not used

1.3.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes.

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

g. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications

1.3.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract

set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate.

1.4 MECHANICAL TESTING AND BALANCING

All contract requirements of Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC must be fully completed, including all testing, prior to contract completion date. In addition, all contract requirements of Section 23 05 93 TESTING, ADJUSTING AND BALANCING must be fully completed, including testing and inspection, prior to contract completion date

1.5 OPERATION AND MAINTENANCE MANUALS

Submit two copies of the project operation and maintenance manuals.

1.5.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data are to be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.5.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the task order provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services.

1.6 CLEANUP

Provide final cleaning in accordance with ASTM E 1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and remove construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport off site and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on site.

Submit documentation for all materials removed from FLETC (e.g. recyclables, solid waste, etc.). Submit disposal/recycling tickets and truck transportation tickets for all material loads removed from FLETC. All transportation and landfill tickets shall bear the original signatures, load weights, and name of disposal/recycling facility. Provide for proper chain-of-custody for all materials, project site to disposal/recycling site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 81 19

INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 008	(2007) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SUMMARY

Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out after construction, pre-occupancy.

1.3 DESCRIPTION, GENERAL

a. IAQ Management During Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:

1. Practices which minimize the amount of dust generated.

2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.

3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.

4. No visible haze in the air.

b. IAQ Management Plan Before Occupancy: Minimize indoor pollutant concentrations to required levels prior to Owner occupancy.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction IAQ Management Plan During Construction;

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN DURING CONSTRUCTION

a. General IAQ Plan requirements during construction include:

1. Compliance with ANSI/SMACNA 008 "SMACNA Guidelines for Occupied Buildings Under Construction."

2. Provide solid physical barriers to isolate areas of construction. Securely attach and seal at floor and structure above.

3. Schedule adequate time for product installation.

4. Maintain negative pressure in construction area.

5. Do not recirculate air prior to occupancy.

6. Seal return air ducts and use direct exhaust to outside.

7. Factory age sheet goods.

8. Comply with manufacturer's instructions for appropriate drying times.

9. Protect installed absorbent materials with recycled or recyclable materials.

b. The IAQ Plan shall meet or exceed the five SMACNA requirements and shall include the following measures:

1. HVAC Protection.

2. Source Control.

3. Pathway Interruption.

4. Housekeeping.

5. Scheduling.

c. HVAC Protection:

1. Protect air handling and distribution equipment, and air supply and return ducting during construction.

2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.

3. Apply protection immediately after installation of equipment and ducting.

4. Ducting runs that require more than a single day to install shall be protected at the end of each day's Work.

5. During dust producing activities, (e.g., drywall installation and finishing), turn the ventilation system off, and protect HVAC supply and return openings from dust infiltration. Provide temporary ventilation as required.

6. If the air handling system is used during construction, MERV 8 filtration media is required on all air handling units, and return air grills or any open vents. The filter media needs to be maintained and replaced before occupancy or if it becomes clogged with debris.

d. Source Control:

1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.

2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.

3. Preconditioning:

a) Prior to delivery to the construction site allow products that have odors and significant volatile organic compound (VOC) emissions to off-gas in dry, well ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions.

b) Condition products, without containers and packaging, to maximize off-gassing of VOCs.

c) Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period.

d) Do not ventilate within limits of Work unless otherwise accepted by Contracting Officer.

e) Comply with substitution requirements for consideration of other locations.

4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.

5. Replace moldy materials with new, undamaged materials.

6. Provide sufficient ventilation, air circulation and air changes to dissipate excess humidity when present.

e. Pathway Interruption:

1. All openings within the designated work area shall be sealed.

2. Adequate exhaust ventilation equipment shall be installed to maintain a negative pressure differential between the work area and adjacent areas of the building.

3. Ventilation units shall be exhausted to the outside of the building.

f. Housekeeping:

1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.

2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:

a) Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is stated in these Specifications, a period of 72 hours shall be used.

b) Ventilate areas directly to outside, do not ventilate to other enclosed spaces.

c) If continuous ventilation is not possible via the building's HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.

3. Suppress dust with wetting agents or sweeping compounds.

4. Clean-up dust using a wet rag or damp mop.

5. Increase the cleaning frequency when dust build-up is noted.

6. Remove spills or excess applications of solvent-containing products as soon as possible.

7. Remove accumulated water and keep work areas as dry as possible.

8. Store volatile liquid containers closed when the container is inside of the building and not in use.

9. Keep volatile liquid containers closed when the container is inside of the building and not in use.

10. HEPA vacuuming and duct cleaning:

a) Vacuum carpeted and soft surfaces with a high efficiency particulate arrestor (HEPA) vacuum.

b) If ducts contain dust and dirt, clean them using a HEPA vacuum immediately before substantial completion and prior to using the ducts to circulate air.

c) Oil film on sheet metal should be removed before shipment to site. However, ducts will be inspected to confirm that no oil film is present. Remove any oil.

11. Use nontoxic cleaning materials and procedures:

a) Alternatives to toxic cleaning agents include:

1) Vinegar.

2) Citrus.

3) Borax.

4) Cornstarch.

5) Baking soda.

b) Examples of nontoxic alternatives for several cleaning methods are listed below:

1) Abrasive cleaners: Substitute half lemon dipped in borax.

2) Ammonia cleaners: Substitute vinegar, salt, and water mixture; or baking soda and water.

3) Disinfectants: Substitute half cup borax in a gallon of water.

4) Drain cleaners: Substitute one fourth cup baking soda and one fourth cup vinegar in boiling water.

5) Upholstery cleaners: Substitute dry cornstarch.

g. Scheduling:

1. Where odorous and/or high VOC-emitting products are applied on site, apply them before installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.

2. Insure that wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are properly and fully cured before installing other finish materials over them.

3. Install carpets and furnishings after all other interior finish materials have been applied and fully cured.

4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.

-- End of Section --

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance with ACI MCP PACK Parts 2 and 3.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI MCP PACK	(2011) Manual of Concrete Practice

ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615/A615M	(2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C 330	(2005) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C1064/C1064M	(2008) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C143/C143M	(2010a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2010b) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2010) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2011) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2008a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2011b) Standard Specification for Ready-Mixed Concrete
ASTM D1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.3 SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in

accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples for strength tests not less than once each shift in which concrete is produced from each class of concrete required. Provide a minimum of three specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, and one will be tested at 7 days for information.

1.3.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'c, and no individual acceptance test result falls below f'c by more than 500 psi.

1.3.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed.Surface requirements for the classes of finish required are as specified in Part 4 of ACI MCP PACK.

1.3.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions shall include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. Specified compressive strength f'c shall be 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 1 inch, in accordance with ACI MCP PACK Part 3. The air content shall be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water cement ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Water-Reducing or Retarding Admixture
Curing Materials
Expansion Joint Filler Strips, PremoldedJoint Sealants - Field Molded Sealants

Conveying and Placing Concrete
Formwork
Forms
Ready-Mix Concrete
Mix Design Data;
Fly Ash
Accessories, Curing Compound

SD-06 Test Reports

Aggregates
Concrete Mixture Proportions
Compressive Strength Testing
Slump

SD-07 Certificates

Cementitious Materials
Aggregates
Bill of Lading

1.5 QUALITY ASSURANCE

Indicate specific locations of Steel Reinforcement on installation drawings and include, but not be limited to, square feet of concrete placements, thicknesses and widths, plan dimensions, and arrangement of cast-in-place concrete section.

PART 2 PRODUCTS

2.1 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.1.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.1.1.1 Portland Cement

ASTM C150/C150M, Type I.

2.1.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class C or F, including requirements of Tables 1A and 2A.

2.1.2 Aggregates

Fine and coarse aggregates shall meet the quality and grading requirements of ASTM C33/C33M Class Designations 4M or better. Perform evaluation of fine and coarse aggregates separately and in combination, matching the proposed mix design proportioning. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

Aggregates for lightweight concrete shall meet ASTM C 330.

2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply with the appropriate specification listed.

2.1.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.1.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

2.1.4 Water

Use fresh, clean, potable water for mixing and curing, free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

2.1.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60. Welded steel wire fabric shall conform to the requirements of ASTM A185/A185M. Details of reinforcement not shown shall be in accordance with ACI MCP PACK Part 3, Chapters 7 and 12.

2.1.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded shall be sponge rubber conforming to ASTM D1752, Type I.

2.1.7 Joint Sealants - Field Molded Sealants

Joint sealants - field molded sealants shall conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

2.1.8 Formwork

The design and engineering of the formwork as well as its construction, will be the responsibility of the Contractor.

2.1.9 Form Coatings

Coat forms, for exposed surfaces, with a nonstaining form oil to be applied shortly before concrete is placed.

2.1.10 Curing Materials

Provide curing materials conforming to the following requirements.

2.1.10.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C171, type optional, except polyethylene film, if used, shall be white opaque.

2.1.10.2 Membrane-Forming Curing Compound

ASTM C309, Type 1-D or 2, Class A.

2.2 READY-MIX CONCRETE

a. Concrete shall be ready-mix concrete with mix design data conforming to ACI MCP PACK Part 2. Bill of Lading for each ready-mix concrete delivery shall be in accordance with ASTM C94/C94M.

b. Non-exposed concrete elements: 3000 psi minimum compressive strength.

c. Slump: 1 to 4 inch according to ASTM C143/C143M and ACI MCP PACK Part 1.

d. Portland Cement conforming to ASTM C150/C150M, Type I or II.

e. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

f. Air-Entraining Admixtures conforming to ASTM C260/C260M. Exterior concrete exposed to freezing needs to be air-entrained 4.5 to 7.5 percent by volume. Nonair-entrained interior concrete shall have a total air content of 2 to 4 percent by volume.

g. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C494/C494M.

h. Fly Ash used as an admixture shall conform to ASTM C618, Class C or F with 4 percent maximum loss on ignition and 35 percent maximum cement replacement by weight. Submit documentation in compliance with 40 CFR 247.

2.3 STEEL REINFORCEMENT

2.3.1 Deformed Steel Bars

Provide steel bars conforming to ASTM A615/A615M, Grade .60 ksi ACI MCP PACK Parts 2 and 3.

2.3.2 Welded Wire Fabric

Provide welded wire fabric conforming to ASTM A185/A185M.

2.4 FORMS

Forms shall be of wood, steel, or other approved material and conform to ACI MCP PACK, Parts 2 and 3.

Provide form release conforming to ACI MCP PACK, Part 4.

2.5 ACCESSORIES

2.5.1 Curing Compound

Provide curing compound conforming to ASTM C309.

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface shall be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Earth foundations shall be satisfactorily compacted. Ensure spare vibrators are available. The entire preparation shall be accepted by the Government prior to placing.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Embedded items shall be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

3.1.2 Formwork Installation

Forms shall be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

3.1.3 Production of Concrete

3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

3.2 CONVEYING AND PLACING CONCRETE

Concrete placement is not permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, deliver the concrete to the site of the work completing the discharge within 1-1/2 hours. Convey concrete from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Deposit concrete as close as possible to its final position in the forms and regulate it so that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. Carry on the placement at such a rate that the formation of cold joints will be prevented. Submit Methods and equipment for transporting, handling, depositing, and consolidating the concrete prior to the first concrete placement. Perform conveying and placing concrete in conformance with the following:

3.2.1 Consolidation

Consolidate each layer of concrete by internal vibrating equipment. Systematically accomplish internal vibration by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by approximately 4 inches. Ensure that the vibrator penetrates rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. Hold vibrator stationary until the concrete is consolidated and then withdraw it slowly at the rate of about 3 inches per second.

3.2.2 Cold-Weather Requirements

No concrete is to be mixed or placed when the ambient temperature is below 36 degrees F or if the ambient temperature is below 41 degrees F and falling. Provide suitable covering and other means as approved for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing. Remove and replace concrete damaged by freezing at the expense of the Contractor.

3.2.3 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI MCP PACK Part 2, is expected to exceed 0.2 psf per hour, provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures taken as quickly as finishing operations will allow.

3.2.4 Lifts in Concrete

Deposit concrete in horizontal layers not to exceed 24 inches in thickness. Carry on placement at a rate that prevents the formation of cold joints. Place slabs in one lift.

3.3 FORM REMOVAL

Do not remove forms before 24 hours after concrete placement, except as otherwise specifically authorized. Do not remove supporting forms and shoring until the concrete has cured for at least 5 days. When conditions require longer curing periods, forms shall remain in place.

3.4 FINISHING

3.4.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.4.2 Finishing Formed Surfaces

Remove all fins and loose materials, and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete shall be reamed or chipped and filled with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured is the same as adjacent concrete.

3.4.3 Finishing Unformed Surfaces

Float finish all unformed surfaces, that are not to be covered by additional concrete or backfill, to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Slope exterior surfaces for drainage unless otherwise shown. Carefully make joints with a jointing tool. Finish unformed surfaces to a tolerance of 3/8 inch for a float finish and 5/16 inch for a trowel finish as determined by a 10 foot straightedge placed on surfaces shown on the drawings to be level or having a constant slope. Do not perform finishing while there is excess moisture or bleeding water on the surface. No water or cement is to be added to the surface during finishing.

3.4.3.1 Float Finish

Provide float finished surfaces, screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete supports a person's weight without deep imprint, complete floating. Floating shall embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

3.5 CURING AND PROTECTION

Beginning immediately after placement, and continuing for at least 7 days, cure and protect all concrete from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. Provide all materials and equipment needed for adequate curing and protection at the site of the placement prior to the start of concrete placement. Accomplish moisture preservation of moisture for concrete surfaces not in contact with forms by one of the following methods:

a. Continuous sprinkling or ponding.

b. Application of absorptive mats or fabrics kept continuously wet.

c. Application of sand kept continuously wet.

d. Application of impervious sheet material conforming to ASTM C171.

e. Application of membrane-forming curing compound conforming to ASTM C309, Type 1-D, on surfaces permanently exposed to view. Accomplish Type 2 on other surfaces in accordance with manufacturer's instructions.

Accomplish the preservation of moisture for concrete surfaces placed against wooden forms by keeping the forms continuously wet for 7 days. If forms are removed prior to end of the required curing period, use other curing methods for the balance of the curing period. Do not perform protection removal if the temperature of the air in contact with the concrete may drop more than 60 degrees F within a 24 hour period.

3.6 TESTS AND INSPECTIONS

3.6.1 Field Testing Technicians

The individuals who sample and test concrete, as required in this specification, shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.6.2 Inspection Details and Frequency of Testing

3.6.2.1 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

3.6.2.2 Air Content

Check air content at least once during each shift that concrete is placed for each class of concrete required. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C231/C231M.

3.6.2.3 Slump

Check slump once during each shift that concrete is produced for each class of concrete required. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C143/C143M.

3.6.2.4 Consolidation and Protection

Ensure that the concrete is properly consolidated, finished, protected, and cured.

3.6.3 Action Required

3.6.3.1 Placing

Do not permit placing to begin until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Do not continue placing if any pile is inadequately consolidated.

3.6.3.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.6.3.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

3.6.4 Reports

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within 3 days after the end of each weekly reporting period. See Section 01 45 00.00 10 QUALITY CONTROL.

3.7 FORM WORK

Form work shall conform to ACI MCP PACK Parts 2 through 5.

3.7.1 Preparation of Form Surfaces

Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces for permanently exposed faces shall be smooth, free from irregularities, dents, sags, or holes. Chamfer exposed joints and exposed edges. Arrange internal ties so that when the forms are removed, the form ties are not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structure.

3.7.2 Form Coating

Coat forms, for exposed surfaces, with a nonstaining form release coating applied. Forms for unexposed surfaces may be wetted in lieu of coating immediately before the placing of concrete, except that in freezing weather form release coating shall be used.

3.7.3 Removal of Forms

Remove forms carefully to prevent damage to the concrete. Do not remove forms before the expiration of the minimum time indicated below:

Arches, beams and deck-type slabs	144 hours
Columns and walls (lifts 15 feet and under)	24 hours
Columns and walls (lifts over 15 feet)	48 hours

3.8 STEEL REINFORCING

Reinforcement shall be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.8.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI MCP PACK Parts 2 and 3. Shop details and bending shall be in accordance with ACI MCP PACK Parts 2 and 3.

3.8.2 Splicing

Perform splices in accordance with ACI MCP PACK Parts 2 and 3.

3.8.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.9 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.10 FIELD TESTING

a. Provide samples and test concrete for quality control during placement. Sampling of fresh concrete for testing shall be in accordance with ASTM C172/C172M.

b. Test concrete for compressive strength at 7 and 28 days for each design mix. Concrete test specimens shall conform to ASTM C31/C31M. Perform Compressive strength testing conforming to ASTM C39/C39M.

c. Test Slump at the site of discharge for each design mix in accordance with ASTM C143/C143M.

d. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or test extremely porous aggregates in accordance with ASTM C173/C173M.

e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M.

-- End of Section --

SECTION 04 20 00

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 530/530.1	(2011) Building Code Requirements and Specification for Masonry Structures and Related Commentaries
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A615/A615M	(2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A82/A82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C1019	(2011) Standard Test Method for Sampling and Testing Grout
ASTM C1072	(2010) Standard Test Method for Measurement of Masonry Flexural Bond Strength
ASTM C1142	(1995; R 2007) Standard Specification for Extended Life Mortar for Unit Masonry
ASTM C129	(2011) Standard Specification for Nonloadbearing Concrete Masonry Units

ASTM C144	(2011) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C207	(2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	(2010) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2010) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C593	(2006) Fly Ash and Other Pozzolans for Use with Lime for Soil Stabilization
ASTM C62	(2010) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C641	(2009) Staining Materials in Lightweight Concrete Aggregates
ASTM C652	(2010) Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C67	(2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C780	(2011) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C90	(2011a) Loadbearing Concrete Masonry Units
ASTM C91	(2005) Masonry Cement
ASTM C94/C94M	(2011a) Standard Specification for Ready-Mixed Concrete
ASTM C989	(2010) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D 2240	(2005; R 2010) Standard Test Method for Rubber Property - Durometer Hardness

ASTM D 2287 (1996; R 2010) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2009; Errata First Printing) International Building Code

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Not used

1.2.3 Not used

1.2.4 Design Requirements

1.2.4.1 Unit Strength Method

Compute compressive strength of masonry system "Unit Strength Method", ACI 530/530.1. Submit calculations and certifications of unit and mortar strength.

1.2.4.2 Seismic Requirement

In addition to design requirements of ICC IBC, provide additional seismic reinforcement as detailed on the drawings. The total minimum reinforcing percentage for structural walls shall be 0.20 percent and non-structural walls shall be 0.15 percent. The maximum spacing of reinforcing bars shall be as follows:

Wall Type	Vertical	Horizontal
Structural	24 inches	48 inches
Non-structural	48 inches	80 inches

Bond beams are required at the top of footings, at the bottom and top of openings at roof and floor levels, and at the top of parapet walls.

1.2.4.3 Masonry Strength

Determine masonry strength in accordance with ACI 530/530.1; submit test reports on three prisms as specified in ACI 530/530.1. The cost of testing shall be paid by the Contractor.

1.2.5 Additional Requirements

a. Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Cement
Brick
Insulation
Cold Weather Installation

SD-04 Samples

Brick
Anchors, Ties, and Bar Positioners

SD-05 Design Data

Pre-mixed Mortar
Unit Strength Method

SD-06 Test Reports

Efflorescence Test
Field Testing of Mortar
Field Testing of Grout
Prism tests
Masonry Cement

SD-07 Certificates

Concrete Masonry Units (CMU)

SD-08 Manufacturer's Instructions

Masonry Cement

1.4 QUALITY ASSURANCE

1.4.1 Appearance

Blend all CMU/brick to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable.

1.4.2 Detail Drawings

Submit detail drawings showing bar splice locations. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during

construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66. Submit drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, stored, handled, and protected to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.5.1 Masonry Units

Cover and protect moisture-controlled concrete masonry units and cementitious materials from precipitation. Conform to all handling and storage requirements of ASTM C90. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.5.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.5.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination or segregation.

1.6 PROJECT/SITE CONDITIONS

Conform to ACI 530/530.1 for hot and cold weather masonry erection.

1.6.1 Hot Weather Installation

Take the following precautions if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent or the ambient air temperature exceeds 90 degrees F and the wind velocity is more than 8 mph. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

1.6.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F or temperature of masonry units is below 40 degrees F, submit a written statement of proposed cold weather construction procedures for approval.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.Submit sample of colored mortar with applicable masonry unit and color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture. Submit test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2 CLAY OR SHALE BRICK

Submit brick samples as specified. Color range and texture of clay or shale brick shall be as indicated and shall conform to the approved sample. Brick shall conform to ASTM C62; Grade SW shall be used for brick in contact with earth or grade and for all exterior work and for all nonvertical surfaces. Average dimensions of brick shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long (standard) or 4 inches thick, 2-2/3 inches high, and 8 inches long (nominal), subject to the tolerances specified in ASTM C62. Brick shall be tested for efflorescence. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.1 Solid Clay or Shale Brick

Solid clay or shale brick shall conform to ASTM C62, Type FBX. Brick size shall be modular and the nominal size of the brick used shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long (nominal) or 4 inches thick, 2-2/3 inches high and 8 inches long (nominal). Minimum compressive strength of the brick shall be 2200 psi.

2.2.2 Hollow Clay or Shale Brick

Hollow clay or shale brick shall conform to ASTM C652, Type HBX. Brick size shall be modular and the nominal size of the brick used shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long. Where vertical reinforcement is shown in hollow brick, the minimum cell dimension shall be 2-1/2 inches and the units shall be designed to provide precise vertical alignment of the cells. Minimum compressive strength of the brick shall be 2200 psi.

2.4 CONCRETE MASONRY UNITS (CMU)

Submit samples and certificates as specified. Cement shall have a low alkali content and be of one brand. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Units may contain post-consumer or post-industrial recycled content. Units shall be of modular dimensions and air, water, or steam cured. Surfaces of units

which are to be plastered or stuccoed shall be sufficiently rough to provide bond; elsewhere, exposed surfaces of units shall be smooth and of uniform texture. Exterior concrete masonry units shall have water-repellant admixture added during manufacture.

a. Hollow Load-Bearing Units: ASTM C90, made with lightweight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Hollow Non-Load-Bearing Units: ASTM C129, made with lightweight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

c. Solid Load-Bearing Units: ASTM C90, lightweight units. Provide solid units as indicated.

2.4.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification. Use industrial waste by-products (air-cooled slag, cinders, or bottom ash), ground waste glass and concrete, granulated slag, and expanded slag in aggregates. Slag shall comply with ASTM C989; Grade 80.

2.5 MORTAR FOR STRUCTURAL MASONRY

ASTM C270, Type S. Strength (f'm) as indicated. Test in accordance with ASTM C780. Use Type I portland cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar and 18 percent in masonry cement mortar. Use up to 40 percent Class F fly ash with type IP cement in cement-lime mortar. Fly ash shall comply with ASTM C593.

2.6 MASONRY MORTAR

Mortar Type S shall conform to the proportion specification of ASTM C270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; Type N cement-lime mortar proportions shall be 1 part cement, 1 part lime and 6 parts aggregate. Type N or S mortar shall be used for non-load-bearing, non-shear-wall interior masonry; and Type S for remaining masonry work; except where higher compressive strength is indicated on structural drawings. When masonry cement ASTM C91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C780 and ASTM C1072. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.6.1 Admixtures for Masonry Mortar

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall

contain less than 0.2 percent chlorides, and shall conform to ASTM C494/C494M, Type C. Submit the required certifications.

2.6.2 Hydrated Lime and Alternates

Hydrated lime shall conform to ASTM C207, Type S.

2.6.3 Cement

Portland cement shall conform to ASTM C150/C150M, Type I, II, or III. Masonry cement shall conform to ASTM C91, Type NS. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar. Incorporate to the maximum extent, without conflicting with other requirements of this section, up to 40 percent fly ash, up to 70 percent slag, up to 10 percent cenospheres, and up to 10 percent silica fume. When masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required. Additives shall conform to requirements in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

2.6.4 Pre-Mixed Mortar

Pre-mixed mortar shall conform to ASTM C1142, Type RS. Submit pre-mixed mortar composition.

2.6.5 Sand and Water

Sand shall conform to ASTM C144. Water shall be clean, potable, and free from substances which could adversely affect the mortar.

2.7 WATER-REPELLANT ADMIXTURE

Polymeric type formulated to reduce porosity and water penetration and water absorption of the mortar and masonry units.

2.8 GROUT AND READY-MIXED GROUT

Grout shall conform to ASTM C476, fine . Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 11 inches. Minimum grout strength shall be 2000 psi in 28 days, as tested by ASTM C1019. Use grout subject to the limitations of Table III. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Ready-Mixed grout shall conform to ASTM C94/C94M.

2.8.1 Admixtures for Grout

In cold weather, a non-chloride based accelerating admixture may be used subject to approval; accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C494/C494M, Type C. In general, air-entrainment, anti-freeze or chloride admixtures shall not be used except as approved by the Contracting Officer. Submit required certifications.

2.8.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.9 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A153/A153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A82/A82M. Wire ties or anchors in exterior walls shall conform to ASTM A641/A641M. Joint reinforcement in interior walls, and in exterior or interior walls exposed to moist environment shall conform to ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face. Submit two anchors, ties and bar positioners of each type used, as samples.

2.9.1 Wall Ties

Provide wall ties rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.9.2 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.10 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A82/A82M, welded construction.Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A153/A153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

2.11 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A615/A615M, Grade 60.

2.12 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.13 RIGID BOARD-TYPE INSULATION

Provide rigid board-type insulation as specified in Section 07 21 13 BOARD AND BLOCK INSULATION. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires. Submit certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

2.14 EXPANSION-JOINT MATERIALS

Sealant shall conform to Section 07 92 00 JOINT SEALANTS.

2.15 THROUGH WALL FLASHING

Flashing shall be specified in Section 07 60 00 FLASHING AND SHEET METAL.

a. Coated-Copper Flashing: 7 ounce, electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, elastic bituminous compound. Factory apply coating to a weight of not less than 6 ounces/square foot (approximately 3 ounces/square foot on each side).

b. Copper or Stainless Steel Flashing: Copper, ASTM B370, minimum 16 ounce weight; stainless steel, ASTM A167, Type 301, 302, 304, or 316, 0.015 inch thick, No. 2D finish. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.

2.16 WEEP HOLE VENTILATORS

Weep hole ventilators shall be prefabricated aluminum, plastic or wood blocking sized to form the proper size opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance or insects. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 PREPARATION

Prior to start of work, masonry inspector shall verify the applicable conditions as set forth in ACI 530/530.1, inspection.

3.1.1 Protection

Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F

b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.1.3 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.1.4 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.1.5 Surfaces

Clean surfaces on which masonry is to be placed of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

3.2 LAYING MASONRY UNITS

a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic.

b. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb.

c. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

d. In double wythe construction, the inner wythe may be brought up not more than 16 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

3.2.1 Forms and Shores

Provide bracing and scaffolding as required. Design bracing to resist wind pressure as required by local codes. Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.2 Reinforced Concrete Masonry Units Walls

Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Clay or Shale Brick Units

Lay brick facing with the better face exposed. Lay brick in running bond with each course bonded at corners, unless otherwise indicated. Lay molded brick with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid. Test clay or shale brick daily on the job, prior to laying, as follows: Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks. Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested.

3.2.4.2 Solid Units

Completely fill bed, head, and collar joints with mortar.

3.2.4.3 Hollow Units

Lay hollow units as specified for concrete masonry units.

3.2.4.4 Brick-Faced Walls

For brick-faced walls bond the two wythes in every sixth brick course with continuous horizontal joint reinforcement. Provide additional bonding ties spaced not more than 3 feet apart around the perimeter of and within 12 inches of all openings.

a. Collar Joints: Fill collar joints solid with mortar as each course of brick is laid. Do not disturb units in place.

b. Brick Sills: Lay brick on edge, slope, and project not less than 1/2 inch beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

3.2.4.5 Cavity Walls

Provide a continuous cavity as indicated. Securely tie the two wythes together with horizontal joint reinforcement. Bevel mortar beds away from cavity to prevent projection into cavity when bricks are shoved in place. Keep cavities clear and clean of mortar droppings. At the bottom of cavity walls, in the course immediately above the through-wall flashing, temporarily omit one brick every 4 feet. With a hose and clean water, wash all mortar droppings and debris out of the cavity through the temporary openings at least twice each day masonry is laid, and more often when required to keep the cavities clean. Fill in the openings with bricks and mortar after the wall is complete and the cavity has been inspected and found clean. Provide weep holes of open head joints spaced 24 inches o.c. wherever the cavity is interrupted and at base of wall and vertical obstructions (e.g. lintels).

3.2.5 Tolerances

Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Square corners unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, lay masonry within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

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In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation from level for bed joints and top surfaces of bearing walls

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In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of columns and in thickness of walls

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Minus	1/4 inch
Plus	1/2 inch

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.9 Embedded Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout.

3.2.10 Unfinished Work

Step back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved by the COR. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.2.11 Masonry Wall Intersections

Masonry bond each course at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond

beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.3 WEEP HOLES

Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated on drawings. Weep holes shall be open head joints. at 24 inches o.c. Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be perfectly horizontal or slightly canted downward to encourage water drainage outward and not inward. Weep holes shall be constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.4 MORTAR MIX

Mix mortar in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measure ingredients for mortar by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Mix water with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Retemper mortar that has stiffened because of loss of water through evaporation by adding water to restore the proper consistency and workability. Discard mortar that has reached its initial set or that has not been used within 2.5 hours after mixing.

3.5 REINFORCING STEEL

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.5.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.5.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.6 JOINT REINFORCEMENT INSTALLATION

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

3.7 PLACING GROUT

Fill cells containing reinforcing bars with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.7.1 Vertical Grout Barriers for Fully Grouted Walls

Provide grout barriers not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.7.2 Horizontal Grout Barriers

Embed grout barriers in mortar below cells of hollow units receiving grout.

3.7.3 Grout Holes and Cleanouts

3.7.3.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 16 inches on centers where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

3.7.3.2 Cleanouts for Hollow Unit Masonry Construction

Provide cleanout holes at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be

exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.7.3.3 Cleanouts for Solid Unit Masonry Construction

Provide cleanouts for construction of walls consisting of a grout filled cavity between solid masonry wythes at the bottom of every pour by omitting every other masonry unit from one wythe. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Do not plug cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.7.4 Grouting Equipment

3.7.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Operate pumps to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.7.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. Maintain at least one spare vibrator at the site at all times. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

3.7.5 Grout Placement

Lay masonry to the top of a pour before placing grout. Do no place grout in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.7.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours

that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.7.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses.Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

(1) The actual grout space or cell dimension shall be larger than the sum of the following items:

a) The required minimum dimensions of total clear areas given in the table above;

b) The width of any mortar projections within the space;

c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.8 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.9 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using mortar to fill the head joint in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07 92 00 JOINT SEALANTS. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.10 SHELF ANGLES

Adjust shelf angles as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized and provided in sections not longer than 10 feet and installed with a 1/4 inch gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.

3.11 LINTELS

3.11.1 Precast Concrete and Steel Lintels

Construct precast concrete and steel lintels as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true.

Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.12 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.12.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.12.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.13 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.14 NOT USED

3.15 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs or splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.15.1 Dry-Brushing

a. Exposed concrete masonry unit

b. Exposed concrete brick surfaces

c. Shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.15.2 Clay or Shale Brick Surfaces

Clean exposed clay or shale brick masonry surfaces as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, examine the sample panel of similar material for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, change the method of cleaning to ensure that the masonry surfaces in the structure will not be adversely affected.The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.16 BEARING PLATES

Set bearing plates for beams, joists, joist girders and similar structural members to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated.

3.17 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.18 NOT USED

3.19 TEST REPORTS

3.19.1 Field Testing of Mortar

Take at least three specimens of mortar each day. Spread a layer of mortar 1/2 to 5/8 inch thick on the masonry units and allowed to stand for one minute. Prepare and test the specimens for compressive strength in accordance with ASTM C780. Submit test results.

3.19.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days. Submit test results.

-- End of Section --

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 201	(2006) AISC Certification Program for Structural Steel Fabricators
AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2011) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 810	(1997) Design Guide 10: Erection Bracing of Low-Rise Structural Steel Buildings
ANSI/AISC 341	(2005; Suppl No. 1 2005) Seismic Provisions for Structural Steel Buildings
ANSI/AISC 360	(2010) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2007) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A490	(2010ae1) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2007a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2007) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2011) Standard Specification for Structural Steel Shapes
ASTM B695	(2004; R 2009) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C1107/C1107M	(2011) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C827/C827M	(2010) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
ASTM F 1554	(2007ae1) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F 436	(2011) Hardened Steel Washers
ASTM F 844	(2007a) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(2009) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel
SSPC PS 13.01	(1982; E 2004) Epoxy Polyamide Painting System
SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.756	Steel Erection; Beams and Columns

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer and galvanizing, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with ANSI/AISC 360 and ANSI/AISC 341 except as modified in this contract.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection Plan, including description of temporary supports;

Fabrication drawings including description of connections;

SD-03 Product Data

Shop primer

Welding electrodes and rods

Load indicator washers

Non-Shrink Grout

Include test report for Class B primer.

SD-06 Test Reports

Class B coating

Bolts, nuts, and washers

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel

Bolts, nuts, and washers

Galvanizing

Welding procedures and qualifications

1.4 QUALITY ASSURANCE

1.4.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Fabrication drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Double connections that require an erection seat to comply with OSHA 29 CFR 1926.756(c)(1) shall be shown on the shop drawings, reviewed and approved by the structural engineer of record. Use AWS A2.4 standard welding symbols. Member substitutions of details shown on the contract drawings shall be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.4.2 Certifications

1.4.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing.

1.4.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

Conform to all requirements specified in AWS D1.1/D1.1M.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Steel

ASTM A36/A36M.

2.1.2 High-Strength Structural Steel

2.1.2.1 Low-Alloy Steel

ASTM A572/A572M , Grade 50. ASTM A992/A992M Grade 50.

2.1.3 Structural Shapes for Use in Building Framing

Wide flange shapes, ASTM A992/A992M.

2.1.4 Structural Steel Tubing

ASTM A500/A500M, Grade B.

2.1.5 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B, weight class STD (Standard).

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel, Steel Pipe

2.2.1.1 Bolts

ASTM A307, Grade A; ASTM A325, Type 1. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F 844 washers for ASTM A307 bolts, and ASTM F 436 washers for ASTM A325 and ASTM A490 bolts.

2.2.2 High-Strength Structural Steel and Structural Steel Tubing

2.2.2.1 Bolts

ASTM A325, Type 1.

2.2.2.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

2.2.2.3 Washers

ASTM F 436, plain carbon steel.

2.2.3 Foundation Anchorage

2.2.3.1 Anchor Bolts

Galvanized ASTM F 1554.

2.2.3.2 Anchor Nuts

Galvanized ASTM A563, Grade A, hex style.

2.2.3.3 Anchor Washers

Galvanized ASTM F 844.

2.2.3.4 Anchor Plate Washers

ASTM A36/A36M.

2.2.4 Load Indicator Washers

ASTM F 959. Provide ASTM B695, Class 50, Type 1 galvanizing.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.3.2 Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage. Grout shall be nonmetallic.

2.3.3 Welded Shear Stud Connectors

AWS D1.1/D1.1M.

2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC 325 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 GALVANIZING

ASTM A123/A123M or ASTM A153/A153M, as applicable, unless specified otherwise galvanize after fabrication where practicable.

2.6 FABRICATION

2.6.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded or on surfaces of weathering steels that will be exposed in the completed structure. Do not locate match

markings in areas that will decrease member strength or cause stress concentrations. Affix embossed tags to hot-dipped galvanized members.

2.6.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.6.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.6.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

2.7 DRAINAGE HOLES

Adequate drainage holes shall be drilled to eliminate water traps. Hole diameter shall be 1/2 inch and location shall be indicated on the detail drawings. Hole size and location shall not affect the structural integrity.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 325. Fabrication and assembly shall be done in the shop to the greatest extent possible.

Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC 201 and primed with the specified paint.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

3.2 INSTALLATION

3.3 ERECTION

a. Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC 325. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.

b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC 303 and the structure shall be erected in accordance with AISC 810.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.3.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.4 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with ANSI/AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member. Holes shall not be cut or enlarged by burning. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.4.1 Common Grade Bolts

ASTM A307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.4.2 High-Strength Bolts

ASTM A325 and ASTM A490 bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.4.2.1 Installation of Load Indicator Washers (LIW)

ASTM F 959. Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F 436 washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening. In addition to the LIW, provide flat ASTM F 436 washers under both the bolt head and nut when ASTM A490 bolts are used.

3.5 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

3.6 WELDING

AWS D1.1/D1.1M. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

The Contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.6.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.7 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.7.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.8 GALVANIZING REPAIR

Provide as indicated or specified. Galvanize after fabrication where practicable. Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

3.9 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 2 working days of the date of weld inspection.

3.9.1 Welds

3.9.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification

inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

Inspection by the Government will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use.

3.9.1.2 Nondestructive Testing

AWS D1.1/D1.1M. Test locations shall be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

3.9.2 Load Indicator Washers

3.9.2.1 Load Indicator Washer Compression

Load indicator washers shall be tested in place to verify that they have been compressed sufficiently to provide the 0.015 inch gap when the load indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.005 inch gap when the load indicator washer is placed under the turned element, as required by ASTM F 959.

3.9.3 High-Strength Bolts

3.9.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in ANSI/AISC 360, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

3.9.3.2 Inspection

Inspection procedures shall be in accordance with ANSI/AISC 360. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

-- End of Section --

SECTION 05 21 19

OPEN WEB STEEL JOIST FRAMING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS B2.1	(2005; Errata 2006; Errata 2006) Welding Procedure and Performance Qualification
AWS D1.1/D1.1M	(2006; Errata 2006) Structural Welding Code - Steel

STEEL JOIST INSTITUTE (SJI)

SJI 279167 SPECS/LOADS	(2006) 42nd Edition Standard Specifications and Load Tables for Steel Joists and Joist Girders
SJI MANUAL	(2003) 75 Year Manual, 1928-2003
SJI TD 10	(2003) Technical Digest for the Design of Fire Resistive Assemblies with Steel Joists
SJI TD 8	(1983) Technical Digest for the Welding of Open Web Steel Joists
SJI TD 9	(2006) Technical Digest for the Handling and Erection of Steel Joists and Joist Girders

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 14.01	(1982; E 2004) Steel Joist Shop Painting System
SSPC Paint 15	(1999; R 2004) Steel Joist Shop Primer/Metal Building Primer

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1200	Hazard Communication
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.757	Steel Erection; Open Web Steel Joists

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welder qualification;

SD-02 Shop Drawings

Steel joist framing;

SD-06 Test Reports

Erection inspection

Welding inspections

SD-07 Certificates

Accessories

Certification of Compliance

1.3 REGULATORY REQUIREMENT

All joist girder framing must conform to 29 CFR 1926.757. Secure all joist bridging and anchoring in place prior to the application of any construction loads. Distribute temporary loads so that joist capacity is not exceeded. Do not apply loads to bridging.

1.4 DELIVERY AND STORAGE

Handle, transport, and store joists in a manner to prevent damage affecting their structural integrity. Store all items off the ground in a well drained location protected from the weather and easily accessible for inspection and handling.

1.5 QUALITY ASSURANCE

All work must comply with the requirements set forth in 29 CFR 1926.

1.5.1 Drawing Requirements

Submit steel joist framing drawings. Show joist type and size, layout in plan, and erection details including methods of anchoring, framing at openings, type and spacing of bridging, and details of accessories as applicable.

1.5.2 Certification of Compliance

Prior to construction commencement, submit Material Safety Data Sheet per 29 CFR 1910.1200 for steel joists , and certification for welder qualification, compliance with AWS B2.1, welding operation, and tacker, stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

Submit certification of compliance for the following:

SJI MANUAL
SJI TD 8
SJI TD 9
SJI TD 10
29 CFR 1926
29 CFR 1926.757

PART 2 PRODUCTS

2.1 JOISTS AND ACCESSORIES

Provide design data from SJI 279167 SPECS/LOADS for the joist series indicated.

2.2 PAINTING

2.2.1 Shop Painting

Clean and prime joists in accordance with SSPC Paint 15 and SSPC PS 14.01, Steel Joist Shop Painting System, using only Type I, "Red Oxide Paint."

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Handling and Erection

Conform to SJI 279167 SPECS/LOADS for the joist series indicated.

3.1.2 Welding

All welding must conform to AWS B2.1 and AWS D1.1/D1.1M.

3.2 BEARING PLATES

Provide bearing plates to accept full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate must be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout must be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.3 PAINTING

3.3.1 Touch-Up Painting

After erection of joists, touch-up connections and areas of abraded shop coat with paint of the same type used for the shop coat.

3.3.2 Field Painting

Paint joists requiring a finish coat in conformance with the requirements of Section 09 90 00 PAINTING AND COATING.

3.4 VISUAL INSPECTIONS

3.4.1 Erection Inspection

AWS D1.1/D1.1M, Section 6. Perform erection inspection and field welding inspections with AWS certified welding inspectors. Welding inspectors must visually inspect and mark welds.

-- End of Section --

SECTION 05 30 00

STEEL DECKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100	(1991; R 2008) Cold-Formed Steel Design Manual
AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

FM GLOBAL (FM)

FM DS 1-28	(2002) Design Wind Loads

STEEL DECK INSTITUTE (SDI)

SDI 31	(2007) Design Manual for Composite Decks, Form Decks, and Roof Decks
SDI DDMO3	(2004; Errata 2006; Add 2006) Diaphragm Design Manual; 3rd Edition
SDI DDP	(1987; R 2000) Deck Damage and Penetrations
SDI MOC2	(2006) Manual of Construction with Steel Deck

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20	(2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2010) Structural Engineering

UNDERWRITERS LABORATORIES (UL)

UL 209	(2005; Reprint May 2007) Cellular Metal Floor Raceways and Fittings
UL 580	(2006; Reprint Jul 2009) Tests for Uplift Resistance of Roof Assemblies

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

SD-03 Product Data

Accessories

Galvanizing Repair Paint

Joint Sealant Material

Mechanical Fasteners

Repair Paint

Welder Qualifications

Welding Equipment

Welding Rods and Accessories

SD-07 Certificates

Welding Procedures

Wind Storm Resistance

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide manufacturer's certificates attesting that the decking material meets the specified requirements.

1.3.2 Qualifications for Welding Work

Follows Welding Procedures in accordance with AWS D1.1/D1.1M.

Submit qualified Welder Qualifications in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories.

1.3.3 Regulatory Requirements

1.3.3.1 Wind Storm Resistance

Provide roof construction assembly capable of withstanding an uplift pressure of 90 pounds per square foot when tested in accordance with the uplift pressure test described in the FM DS 1-28 or as described in UL 580 and in general compliance with UFC 3-301-01.

1.3.4 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated

covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of AISI D100.

1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Sheet

Flat rolled carbon steel sheets of structural quality, thickness not less than indicated before coating, meeting the requirements of AISI SG03-3, except as modified herein.

2.1.2 Steel Coating

ASTM A653/A653M designation 2180 G60 galvanized, or ASTM A792/A792M designation AZ55, aluminum-zinc alloy. Apply coating to both sides of sheet. Conform to UL 209 for coating on decking provided as wire raceways.

2.1.3 Mixes

2.1.3.1 Galvanizing Repair Paint for all Decks

Provide a high-zinc-dust content paint for regalvanizing welds in galvanized steel conforming to ASTM A780/A780M.

2.1.4 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to ASTM A36/A36M, merchant quality, Grade Designation SAE/AISI 1023 or SAE/AISI 1025, and hot-dip galvanized in accordance with ASTM A123/A123M.

2.1.5 Joint Sealant Material for Roof Decks

Provide a nonskinning, gun-grade, bulk compound material as recommended by the manufacturer.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.028 inch thick to close open ends at end walls, and openings through deck.

2.2.3 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.2.4 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated or pneumatically driven fasteners, for anchoring the deck to structural supports and adjoining units that are designed to meet the loads indicated. Provide positive locking-type fasteners listed by the Steel Deck Institute and ICC-ES, as approved by the Contracting Officer.

2.2.5 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0295 inch other metal accessories, 0.0358 inch unless otherwise indicated. Accessories must include but not be limited to saddles, welding washers, fasteners, underlapping sleeves.

2.3 FABRICATION

2.3.1 Roof Deck

Conform to ASTM A792/A792M or ASTM A1008/A1008M for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of the steel design thickness required by the design drawings and galvanized.

2.3.1.1 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal 0.0359 inch thick before galvanizing. Bend strips to form a 45-degree cant not less than 5 inch wide, with top and bottom flanges a minimum 3 inch wide. Length of strips 10 feet.

2.3.1.2 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0359 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

2.3.2 Form Deck

Conform to ASTM A653/A653M or ASTM A1008/A1008M. Fabricate form deck of the steel design thickness required by the design drawings. Zinc-coat in conformance with ASTM A653/A653M, G60 coating class.

2.3.3 Touch-Up Paint

Provide touch-up paint for zinc-coated units of an approved galvanizing repair paint with a high-zinc dust content. Touch-up welds with paint conforming to SSPC Paint 20 in accordance with ASTM A780/A780M. Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

For floor decking installation, wire brush, clean, and touchup paint the scarred areas on the top and bottom surfaces of the metal floor decking and on the surface of supporting steel members. Include welds, weld scars, bruises, and rust spots for scarred areas. Touched up the galvanized surfaces with galvanizing repair paint. Touch up the painted surfaces with paint for the repair of painted surfaces.

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with SDI DDMO3 and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical.Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 5/8 inch diameter puddle welds or fastened with screws, powder-actuated fasteners, or pneumatically driven fasteners as indicated on the design drawings and in accordance with manufacturer's recommended procedure and SDI 31. Clamp or weight deck units

to provide firm contact between deck units and structural supports while performing welding or fastening. Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Welding

Perform welding in accordance with AWS D1.3/D1.3M using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in AWS D1.1/D1.1M and AWS D1.3/D1.3M make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. Conform to the recommendations of the Steel Deck Institute and the steel deck manufacturer for location, size, and spacing of fastening. Do not use welding washers at the connections of the deck to supports. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Lap 2 inch deck ends. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of SDI DDMO3. Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of coated finish with zinc-dust paint conforming to ASTM A780/A780M.

3.2.1.2 Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners as listed by the Steel Deck Institute, ICC-ES, the fastener and steel deck manufacturers, and approved by the Contracting Officer. Drive the powder-actuated fasteners with a low-velocity piston tool by an operator authorized by the manufacturer of the powder-actuated tool. Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations.

3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP.Reinforce holes and openings 6 to 12 inch across by 0.0474 inch thick steel sheet at least 12 inch wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inch on center. Reinforce holes and openings larger than 12 inch by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists.

3.2.3 Deck Damage

SDI MOC2, for repair of deck damage.

3.2.4 Accessory Installation

3.2.4.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.2.5 Concrete Work

Prior to placement of concrete, inspect installed decking to ensure that there has been no permanent deflection or other damage to decking. Replace decking which has been damaged or permanently deflected as approved by the Contracting Officer. Place concrete on metal deck in accordance with Construction Practice of SDI 31.

3.3 JOINT SEALING FOR ROOF DECKS

Seal sidelaps and endlaps with manufacturer's recommended joint sealing material. Shop or field apply the material. Before applying the sealing material, completely remove dust, dirt, moisture, and other foreign material from the surfaces to which the sealing material is to be applied. Apply sealing material in strict accordance with the sealing material manufacturer's printed instructions.

3.4 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

3.5 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

3.6 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.7 FIELD QUALITY CONTROL

3.7.1 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges is 1/16 inch; when gap is more than 1/16 inch, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

-- End of Section --

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG02-KIT	(2001; Supp 1 2004) North American Specification for the Design of Cold-Formed Steel Structural Members
AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M	(2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A370	(2011) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1513	(2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM C955	(2011b) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM E329	(2011b) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

ASTM F 1941	(2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
ASTM F 1941M	(2007) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Metric)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components;

a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.

b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.

c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

SD-03 Product Data

Steel studs,joists, tracks, bracing, bridging and accessories

SD-05 Design Data

Metal framing calculations;

SD-07 Certificates

Welds

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Finish of the framing members shall be

maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust. Replace damaged items with new, as directed by the Contracting Officer.

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI SG03-3.

1.5 MAXIMUM DEFLECTION

a. Floor Joists:

L/360 - Live load only
L/240 - Total load

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit framing components to show sizes, thicknesses, layout, material designations, methods of installation, and accessories.

1.6.2 Design Data Required

Submit metal framing calculations to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation. Submit metal framing calculations for any connections, member sizes, or anchorage that deviates from the drawings, provide structural analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

PART 2 PRODUCTS

2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with ASTM C955 and the following.

2.1.1 Studs and Joists of 16 Gage (0.0598 Inch) and Heavier

Galvanized steel, ASTM A653/A653M, SS Grade 50, G60.

2.1.2 Studs and Joists of 18 Gage (0.0478 Inch) and Lighter

Studs and Joists of 18 Gage (0.0478 Inch) and Lighter, Track, and Accessories (All Gages): Galvanized steel, ASTM A653/A653M, SS, Grade 50 33,000 psi G60.

2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Size and gage as indicated. Steel stud deflection shall be limited to L/600 for exterior wall brick veneer construction.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

a. An ICC number.

b. Manufacturer's identification.

c. Minimum delivered uncoated steel thickness.

d. Protective coating designator.

e. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling, tapping screws in compliance with ASTM C1513 of the type, size and location as shown on the drawings. Electroplated screws shall have a minimum 5 micron zinc coating in accordance with ASTM F 1941. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M as appropriate.

2.4 PAINT

Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with corrosion-inhibiting primer, SSPC Paint 25.

2.5 PLASTIC GROMMETS

Supply plastic grommets, recommended by stud manufacturer, to protect electrical wires. Prevent metal to metal contact for plumbing pipes.

PART 3 EXECUTION

3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.1.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI SG02-KIT. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 18 gage.

3.1.2 Screws

Screws shall be self-drilling self-tapping type, size, and location shown on the drawings. Screw penetration through joined materials shall not be less

than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-KIT. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

3.1.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location shown on the drawings.

3.2 INSTALLATION

3.2.1 Tracks

Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 3 inches from the edge of concrete slabs.

3.2.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 2 feet wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI SG03-3, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

LOAD	HEIGHT	BRACING
Axial load	Up to 3000 mm 10 feet	Two rows at 1/3 points
	Over 3000 mm 10 feet	Rows 900 mm 3'-4" o.c. maximum

3.2.3 Joists

Locate each joist directly above a stud. Provide doubled joists under parallel partitions wherever partition length exceeds 1/2 of joist span. Joists shall have at least 2.50 inches of bearing on steel, 4 inches on masonry, and shall be reinforced over bearings where required to prevent web crippling. Splice joists over bearings only. Lap and weld splices as indicated. Provide manufacturer's standard bridging which shall not be less than the following:

CLEAR SPAN	BRIDGING
Up to 4200 mm 14 feet	One row near center
4200 mm to 6000 mm 14 to 20 feet	Two rows at 1/3 points
6000 mm to 7800 mm 20 to 26 feet	Three rows at 1/4 points
7800 mm to 10600 mm 26 to 32 feet	Four rows at 1/5 points

Temporary bracing shall be provided and remain in place until work is permanently stabilized.

3.2.4 Erection Tolerances

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

(1) Layout of walls and partitions: 1/4 inch from intended position;

(2) Plates and runners: 1/4 inch in 8 feet from a straight line;

(3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 1/4 inch in 8 feet from a true plane.

b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

(1) Layout of walls and partitions: 1/4 inch from intended position;

(2) Plates and runners: 1/8 inch in 8 feet from a straight line;

(3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.3	(2006) Operations - Safety Requirements for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.21.1	(2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.6.2	(1998; R 2010) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series
ASME B18.6.3	(2010) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A467/A467M	(2007) Standard Specification for Machine Coil Chain
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B108/B108M	(2008) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B26/B26M	(2009) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C1513	(2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; R 2011e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

ASTM E488 (1996; R 2003) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Embedded angles and plates, installation drawings;

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A36/A36M.

2.1.2 Structural Tubing

ASTM A500/A500M.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.1.5 Anchor Bolts

ASTM A307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.5.1 Post Installed Anchors

Provide diameter as indicated on drawings. Minimum embedment shall be per manufacturer's requirements. Design values listed shall be as tested according to ASTM E488.

a. Minimum allowable pullout value shall be as indicated on drawings.

b. Minimum allowable shear value shall be as indicated on drawings.

2.1.5.2 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

2.1.5.3 Toggle Bolts

ASME B18.2.1.

2.1.5.4 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 or ASTM A307.

2.1.5.5 Powder Actuated Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

2.1.5.6 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.1.5.7 Washers

Provide plain washers to conform to ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.1.

2.1.6 Aluminum Alloy Products

Conform to ASTM B209 for sheet plate, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, 2180 G60, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with a standard mill finish. Provide a coating thickness not less than that specified for protective and decorative

type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45. Provide a polished satin finish on items to be anodized.

2.3 GUARD POSTS (BOLLARDS/PIPE GUARDS)

Provide 8 inch galvanized standard weight steel pipe as specified in ASTM A53/A53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.4 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 inches bearing on masonry at each end.

Provide angles and plates, ASTM A36/A36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A123/A123M.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.6 FINISHES

3.6.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

3.6.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.6.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

-- End of Section --

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20	(2010) American Softwood Lumber Standard

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Eng Man	(2010) Manual for Railway Engineering

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E445	(2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
APA F405	(1999) Performance Rated Panels
APA L870	(2010) Voluntary Product Standard, PS 1-09, Structural Plywood
APA S350	(2011) Performance Standard for Wood-Based Structural-Use Panels

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts
ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM D3498	(2011) Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
ASTM D6007	(2002; R 2008) Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber
ASTM E1333	(2010) Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

FOREST STEWARDSHIP COUNCIL (FSC)

FSC-STD-01-001	(1993; R 2002) FSC Principles and Criteria (version 4-0) EN

GREEN SEAL (GS)

GS-36	(2000) Green Seal Standard, Adhesives for Commercial Use

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2007) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2006) Standard Grading Rules for Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec	(1986; Supple. No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2002) Standard Grading Rules for Southern Pine Lumber

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS56	(1973) Structural Glued Laminated Timber

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923	(Rev A; Notice 2) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 2) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors
CID A-A-1925	(Rev A; Notice 2) Shield Expansion (Nail Anchors)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(1998) Western Lumber Grading Rules

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Modifications of structural members;

Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

1.4.2 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870.Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

1.4.3 Structural-Use and OSB Panels

Mark each panel with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the panel. The mark shall indicate end use, span rating, and exposure durability classification. Oriented Strand Board (OSB), APA F405.

1.5 SIZES AND SURFACING

ALSC PS 20 for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

a. Framing lumber and board, 19 percent maximum

b. Materials other than lumber; moisture content shall be in accordance with standard under which the product is produced

1.7 QUALITY ASSURANCE

1.7.1 Drawing Requirements

For fabricated structural members, trusses, qlue-lam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.2 Data Required

Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.7.3 Certificates of Grade

Submit certificates attesting that products meet the grade requirements specified in lieu of grade markings where appearance is important and grade marks will deface material.

1.7.4 Humidity Requirements

Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

1.8 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible. Lumber shall be FSC-certified.

2.1.2 Engineered Wood Products

Products shall be FSC-certified and shall contain no added urea-formaldehyde if exposed to interior spaces. Determine formaldehyde concentrations in air from engineered wood products under test conditions of temperature and relative humidity in accordance with ASTM D6007 or ASTM E1333. Products shall not be used if formaldehyde concentration is found to be greater than 0.

2.2 LUMBER

2.2.1 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed. Finger-jointed lumber may be used in the same applications as solid lumber of an equivalent species and grade, provided the finger-jointed lumber meets all the requirements of the certification and the quality control programs of the rules writing agency having jurisdiction and all applicable requirements of DOC/NIST PS56.

Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common

NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m 10 feet and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.3 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS

APA L870, APA S350, APA E445, and APA F405 respectively.

2.3.1 Wall Sheathing

2.3.1.1 Plywood

C-D Grade, Exposure 1, and a minimum thickness of 1/2 inch , except where indicated to have greater thickness. FSC-certified.

2.3.1.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1, Span Rating of 16/0 or greater. OSB, APA Rated Sheathing. OSB shall be a phenolic-glued, low-formaldehyde board. FSC-certified.

2.3.2 Other Uses

2.3.2.1 Plywood

Plywood for casework. Plywood shall be FSC-certified.

2.3.2.2 Structural-Use and OSB Panels

Structural-use and OSB panels for casework. Panels shall be FSC-certified.

2.4 OTHER MATERIALS

2.4.1 Miscellaneous Wood Members

2.4.1.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm inch
Bridging	25 x 75 1 x 3 or 25 x 100 1 x 4 for use between members 50 x 300 2 x 12 and smaller; 50 x 100 2 x 4 for use between members larger than 50 x 300 2 x 12.
Corner bracing	25 x 100 1 x 4.
Furring	25 x [50] [75] 1 x 2
Grounds	Plaster thickness by 38.
Nailing strips	25 x 75 1 x 3 or 25 x 100 1 x 4 when used as shingle base or interior finish, otherwise 50 mm 2 inch stock.

2.4.1.2 Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

2.4.1.3 Blocking

Blocking shall be standard or number 2 grade.

2.4.2 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials, GS-36, SCAQMD Rule 1168, and as specified. Use water-based adhesives with maximum VOC content of 15 grams/liter for all interior applications. Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of LEED low emitting materials credit.

2.5 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Fasteners shall be fabricated from 100 percent re-melted steel.See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Fasteners may contain post-consumer or post-industrial recycled content. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip zinc-coated in accordance with ASTM A153/A153M.

2.5.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.5.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.5.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices shall be 3/8 inch.

2.5.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.5.5 Wood Screws

ASME B18.6.1.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Sills

3.1.1.1 Anchors in Masonry

Except where indicated otherwise, Embed anchor bolts not less than 15 inches in masonry unit walls and provide each with a nut and a 2 inch diameter washer at bottom end. Fully grout bolts with mortar.

3.1.1.2 Anchors in Concrete

Except where indicated otherwise, Embed anchor bolts not less than 8 inches in poured concrete walls and provide each with a nut and a 2 inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend shall be not less than 90 degrees. Powder-actuated fasteners spaced 3 feet o.c. may be provided in lieu of bolts for single thickness plates on concrete.

3.1.2 Subflooring

3.1.2.1 Plywood, Structural-Use, and OSB Panels

Apply best side up with the grain of outer plies or the long dimension at right angles to joists. Stagger end joints and locate over the centerline of joists. Support panel edges by nominal 2 by 4 members framed between joists so the edge joints of subfloor occur over the centerline of blocking. Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Panels shall be continuous over two or more spans. Nail panels 6 inches o.c. at supported edges and 10 inches o.c. over intermediate bearing. Nails shall be 8-penny common or 6-penny threaded. Provide at least 1/2 inch clearance between subflooring and masonry or concrete walls. Subflooring may be installed with adhesive conforming to ASTM D3498 and nails spaced at 12 inches on center unless otherwise shown.

3.1.3 Wall Sheathing

3.1.3.1 Plywood, Structural-Use, and OSB Panel Wall Sheathing

Apply horizontally or vertically. Extend sheathing over and nail to sill and top plate. Abut sheathing edges over centerlines of supports. Allow 1/8 inch spacing between panels and 1/8 inch at windows and doors. If sheathing is applied horizontally, stagger vertical end joints. Nail panels with 6-penny nails spaced 6 inches o.c. along edges of the panel and 12 inches o.c. over intermediate supports. Keep nails 3/8 inches away from panel ledges. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

3.1.4 Wood Sheathing

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width.

-- End of Section --

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20	(2010) American Softwood Lumber Standard

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M2	(2007) Standard for Inspection of Treated Wood Products
AWPA M4	(2002) Standard for the Care of Preservative-Treated Wood Products
AWPA P5	(2009) Standard for Waterborne Preservatives

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA PS 1	(1995) Voluntary Product Standard for Construction and Industrial Plywood

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(8th Edition) AWI Quality Standards

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM F 547	(2006) Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	(2010) Cabinet Hardware

FOREST STEWARDSHIP COUNCIL (FSC)

FSC-STD-01-001	(1993; R 2002) FSC Principles and Criteria (version 4-0) EN

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

HPVA HP-1	(2009) American National Standard for Hardwood and Decorative Plywood

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2007) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2006) Standard Grading Rules for Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2002) Standard Grading Rules for Southern Pine Lumber

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS58	(1973) Basic Hardboard (ANSI A135.4)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(1998) Western Lumber Grading Rules

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 4	(2009) Water-Repellent Preservative Non-Pressure Treatment for Millwork

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Submit documentation verifying that no urea-formaldehyde resins were used.

SD-07 Certificates

Certificates of grade

Certificates of compliance

1.3 DETAIL DRAWINGS

The Contractor shall submit detail drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

1.4 CERTIFICATES

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC-STD-01-001 and identify certifying organization.

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

Provide certificates of compliance unless materials bear certification markings or statements.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver lumber, plywood, trim, and millwork to job site in an undamaged condition. Stack materials to ensure ventilation and drainage. Protect against dampness before and after delivery. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity. Do not store products in building until wet trade materials are dry.

1.6 QUALITY ASSURANCE

1.6.1 Lumber

Identify each piece or each bundle of lumber, millwork, and trim by the grade mark of a recognized association or independent inspection agency that

is certified by the Board of Review, American Lumber Standards Committee, to grade the species.

1.6.2 Plywood

Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of the plywood. Mark shall identify plywood by species group or span rating, and shall show exposure durability classification, grade, and compliance with APA PS 1.

1.6.3 Hardboard and Particleboard

Materials shall bear a marking or statement identifying the producer and the applicable standard.

1.6.4 Pressure-Treated Lumber and Plywood

Each treated piece shall be inspected in accordance with AWPA M2.

1.6.5 Nonpressure-Treated Woodwork and Millwork

Mark, stamp, or label, indicating compliance with WDMA I.S. 4.

PART 2 PRODUCTS

2.1 WOOD

2.1.1 Sizes and Patterns of Wood Products

Yard and board lumber sizes shall conform to ALSC PS 20. Provide shaped lumber and millwork in the patterns indicated and standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the applicable standard.

2.1.2 Trim, Finish, and Frames

Provide species and grades listed for materials to be paint finished. Provide materials that are to be stain, natural, or transparent finished one grade higher than that listed. Provide species indicated for materials to be transparent finished. Run trim, except window stools and aprons with hollow backs.

TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH

Grading Rules	Species	Interior Trim, Finish, and Frames
WWPA G-5 grading rules	Aspen Douglas Fir-Larch Douglas Fir-South Engelmann Spruce -Lodgepole Pine Engelmann Spruce Hem-Fir Idaho White Pine	All Species: C & Btr. Select (Choice & Btr Idaho White Pine) or Superior Finish. Western Red Cedar may be graded C & Btr. Select or A & Btr. per Special Western Red Cedar

	Lodgepole Pine Mountain Hemlock Mountain Hemlock -Hem-Fir Ponderosa Pine- Sugar Pine (Ponderosa Pine -Lodgepole Pine) White Woods (Western Woods) Western Cedars Western Hemlock	Rules.
WCLIB 17 standard grading rules	Douglas Fir-Larch Hem-Fir Mountain Hemlock Sitka Spruce Western Cedars Western Hemlock	All Species: C & Btr VG, except A for Western Red Cedar
SPIB 1003 grading rules	Southern Pine	C & Btr
NHLA Rules	Cypress	C-Select
NELMA Grading Rules standard grading rules	Balsam Fir Eastern Hemlock- Tamarack Eastern Spruce Eastern White Pine Norway Pine Northern Pine Northern White Cedar	All Species: C-Select except C & Btr for Eastern White Pine and Norway Pine
RIS Grade Use standard specifications	Redwood	Clear Clear All Heart
NHLA Rules rules	Cypress	B Finish
	Red Gum Soft Elm Birch	Select or Btr (for interior use only)

2.1.3 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA G-5, 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

2.1.4 Softwood Plywood

APA PS 1, thicknesses as indicated.

a. Plywood for Shelving: Interior type, A-B Grade, any species group.

b. Plywood for Countertops: Exterior type, A-C Grade.

2.1.5 Hardwood Plywood

HPVA HP-1, Type II (Interior) , Premium (A) Grade, hardwood veneer core construction, face veneers of thickness indicated.

2.1.6 Hardboard

DOC/NIST PS58, standard type, 1/8 inch thick.

2.2 COUNTER TOPS

2.2.1 Laminated Plastic

ANSI/NEMA LD 3.

2.2.1.1 Countertop Finish

Grade GP 50 or PF 42, satin finish. Color and pattern shall be as indicated.

2.2.1.2 Backing Sheet

BK 20.

2.2.2 Solid Surface

Manufactured from homogeneous solid sheets for filled plastic resin complying with materials and performance requirements of ANSI Z 124.3, for Type 5 or Type 6, without a precoated finish.

2.3 MOISTURE CONTENT OF WOOD PRODUCTS

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products at time of delivery to the job site, and when installed, shall be as follows:

a. Interior Finish Lumber, Trim, and Millwork 1-1/4 Inches Nominal or Less in Thickness: 6 percent on 85 percent of the pieces and 8 percent on remainder.

b. Moisture content of other materials shall be in accordance with the applicable standards.

2.4 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

2.4.1 Pressure Treatment

Lumber and plywood used on the exterior of buildings or in contact with masonry or concrete shall be treated with water-borne preservative listed in AWPA P5 as applicable, and inspected in accordance with AWPA M2. Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standards Committee. Plywood shall be treated to a reflection level as follows:

Exterior wood molding and millwork within 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.5 HARDWARE

Provide sizes, types, and spacings of manufactured building materials recommended by the product manufacturer except as otherwise indicated or specified.

2.5.1 Wood Screws

ASME B18.6.1.

2.5.2 Bolts, Nuts, Lag Screws, and Studs

ASME B18.2.1 and ASME B18.2.2.

2.5.3 Nails

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

2.5.4 Adjustable Shelf Standards

ANSI/BHMA A156.9, Type, surface mounted, with shelf rests Type, bracket.

2.6 FABRICATION

2.6.1 Quality Standards (QS)

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in AWI Qual Stds. Items not specified to be of a specific grade shall be Custom grade. The AWI QS is superseded by all contract document requirements indicated or stated herein.

2.6.2 Countertops

Fabricate with lumber and a core of exterior plywood, glued and screwed to form an integral unit. Bond laminated plastic under pressure to exposed surfaces, using type of glue recommended by plastic manufacturer, and bond a backing sheet under pressure to underside of countertop. Countertop unit shall be post-formed type with no-drip nose, cove moulding, and Style A back splash, and covered with ANSI/NEMA LD 3, Grade PF 42 plastic. Back splash shall be not less than 3-1/2 inches nor more than 4-1/2 inches high.

2.6.3 Cabinets

Wall and base cabinets shall be of the same construction and appearances. Fabricate with solid ends and frame fronts, or with frames all around.

Frames shall be solid hardwood not less than 3/4 by 1-1/2 inches. Ends, bottom, back, partitions, and doors shall be hardwood plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Cover exposed edges of plywood with hardwood strips. Doors, frames, and solid exposed ends shall be 3/4 inch thick; bottom, partitions, and framed ends 1/2 inch minimum; shelves 5/8 inch minimum; back 1/4 inch minimum.

2.6.3.1 Cabinet Hardware

ANSI/BHMA A156.9. Provide cabinet hardware including two self-closing hinges for each door, two side-mounted metal drawer slides for each drawer and pulls for all doors and drawers as follows. Hardware exposed to view shall be stainless steel. All cabinet hardware shall comply with the following requirements:

a. Provide concealed Euro-Style, back mounted hinges with opening to 165 degrees with self-closing feature at less than 90 degrees to its closed position.

b. Drawer slides shall have a static rating capacity of 100 lbs. The slides shall have a self-closing/stay-closed action, zinc or epoxy coated steel finish, ball bearing rollers, and positive stop with lift out design.

c. Drawer pulls shall be wire type pulls with center-to-center dimension not less than3-1/2 inches and cross sectional diameter of 5/16 inch. The handle projection shall be not less than 1-5/16 inches.

d. Drawer catch shall be heavy duty magnetic catch.

2.6.3.2 Finish

Provide a natural factory finish on wood surfaces after fabrication. Finish shall be fabricator's standard natural finish, except that it shall be equivalent to one coat of sealer and one coat of spar varnish on all surfaces and a second coat of spar varnish on surfaces exposed to view. Sand lightly and wipe clean between coats.

2.6.4 Workbenches

Fabricate as indicated. Dovetail and glue drawer corners. Fasten frames with suitable wood screws or bolts. Sand exposed surfaces smooth, and ease exposed edges. Provide two side-mounted, metal, ball-bearing drawer slides for each door.

2.6.5 Casework With Transparent Finish (CTF)

2.6.5.1 AWI Quality Grade (CTF)

Premium grade.

2.6.5.2 Construction (CTF)

Details shall conform to reveal overlay design.

2.6.5.3 Exposed Parts

Oak specie, rotary cut.

2.6.5.4 Semi-Exposed Parts

As specified in the AWI Qual Stds for the grade selected.

2.6.6 Casework With High Pressure Laminate Finish (CHPL)

2.6.6.1 AWI Quality Grade (CHPL)

Premium grade.

2.6.6.2 Construction (CHPL)

Details shall conform to reveal overlay design.

2.6.6.3 Exposed Surfaces

High pressure laminate, color and pattern as indicated.

2.6.6.4 Semi-Exposed Surfaces

As specified in the AWI Qual Stds for the grade selected.

PART 3 EXECUTION

3.1 FINISH WORK

Provide sizes, materials, and designs as indicated and as specified. Apply primer to finish work before installing. Where practicable, shop assemble and finish items of built-up millwork. Joints shall be tight and constructed in a manner to conceal shrinkage. Miter trim and moldings at exterior angles and cope at interior angles and at returns.Material shall show no warp after installation. Install millwork and trim in maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

3.1.1 Exterior Finish Work

Machine-sand exposed flat members and square edges. Machine-finish semi-exposed surfaces. Construct joints to exclude water. In addition to nailing, glue joints of built-up items with waterproof glue as necessary for weather-resistant construction. Provide well distributed end joints in built-up members. Provide shoulder joints in flat work. Hold backs of wide-faced miters together with metal rings and waterproof glue. Fascias and other flat members, unless otherwise indicated, shall be 3/4 inch thick. Provide door and window trim in single lengths. Provide braced, blocked, and rigidly anchored cornices for support and protection of vertical joints. Install soffits in largest practical size. Joints of plywood shall occur over center lines of supports. Fasten soffits with aluminum or stainless steel nails. Back prime all concealed surfaces of exterior trim.

3.1.2 Interior Finish Work

After installation, sand exposed surfaces smooth. Provide window and door trim in single lengths.

3.2 SHELVING

1 inch nominal thick wood shelf material or 3/4 or 23/32 inch thick plywood shelf material supported substantially with end and intermediate supports and arranged to prevent buckling and sagging. Provide cleats except where hook strips are specified or indicated. Where adjustable shelving is indicated, provide standards and brackets or shelf rests for each shelf. Anchor standards to wall at not more than 2 feet o.c.

3.3 MISCELLANEOUS

3.3.1 Counters

Construct as indicated. Conceal fastenings where practicable, fit counter neatly, install in a rigid and substantial manner, and scribe to adjoining surfaces. Provide counter sections in longest lengths practicable; keep joints in tops to a minimum; and where joints are necessary, provide tight hairline joints drawn up with concealed-type heavy pull-up bolts. Glue joints with water-resistant glue and, in addition, make rigid and substantial with screws, bolts, or other approved fastenings.

3.3.2 Cabinets

Install level, plumb, and tight against adjacent walls. Secure cabinets to walls with concealed toggle bolts, and secure top to cabinet with concealed screws. Make cut-outs for fixtures to templates supplied by fixture manufacturer. Carefully locate cut-outs for pipes so that edges of holes will be covered by escutcheons.

3.3.3 Workbenches

Construct as indicated. Install level, plumb, and tight against adjacent construction. Fasten to walls with screws or toggle bolts and to floors with expansion bolts.

3.3.4 Wood Bumpers

Bore, countersink, and bolt in place where indicated.

3.4 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints.Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners.Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

-- End of Section --

SECTION 06 41 16.00 10

LAMINATE CLAD ARCHITECTURAL CASEWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A161.2	(1998) Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds	(8th Edition) AWI Quality Standards

ASTM INTERNATIONAL (ASTM)

ASTM F 547	(2006) Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9	(2010) Cabinet Hardware

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.2	(2009) Medium Density Fiberboard (MDF) for Interior Applications

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 1-A	(2007) Architectural Wood Flush Doors

1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework cabinets as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

SD-03 Product Data

Wood Materials;
Wood Finishes;
Finish Schedule;

SD-04 Samples

Plastic Laminates;
Cabinet Hardware;

SD-07 Certificates

Laminate Clad Casework

1.4 QUALITY ASSURANCE

1.4.1 General Requirements

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the premium grade quality standards as outlined in AWI Qual Stds, Section 400G and Section 400B for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of AWI Qual Stds requirements, in general, and the specific AWI Qual Stds requirements provided in this specification. The quality control statement shall also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

1.5 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

1.6 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Lumber

a. All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal 3/4 inch hardwood.

b. Standing or running trim casework components, which are specified to receive a transparent finish, shall be oak hardwood species, plain sawn. AWI grade shall be premium. Location, shape, and dimensions shall be as indicated on the drawings.

2.1.2 Panel Products

2.1.2.1 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in CPA A208.2.

2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section 06 61 16 SOLID POLYMER (SOLID SURFACING) FABRICATIONS.

2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of ANSI/NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on the drawings. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 5 by 7 inches in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 0.048 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

2.3.3 Horizontal General Purpose Postformable (HGP) Grade

Horizontal general purpose postformable grade plastic laminate shall be 0.042 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

2.3.4 Vertical General Purpose Postformable (VGP) Grade

Vertical general purpose postformable grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of components where postforming is required for curved surfaces.

2.3.5 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.020 inches in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

2.3.6 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.020 inches. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for casework cabinet interior and drawer interior surfaces.

2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be 0.020 inch thick. Material width shall be as indicated on the drawings. Color and pattern shall match exposed door and drawer front laminate pattern and color.

2.6 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include hinges, pulls, drawer glides. All hardware shall conform to ANSI/BHMA A156.9, unless otherwise noted, and shall consist of the following components:

a. Door Hinges: 5 knuckle wrap around type, 26D dull chrome finish, unless specified otherwise.

b. Cabinet Pulls: Wire pull type, satin stainless steel finish, unless specified otherwise.

c. Drawer Slide: Side mounted type, 26D dull chrome finish with full extension and a minimum 100 pound load capacity. Slides shall include an integral positive stop to avoid accidental drawer removal.

d. Adjustable Shelf Support System:

(1) Recessed (mortised) metal standards, BHMA No. BO4071, finish: 26D. Support clips for the standards shall be closed type, BHMA No. B04081, finish: satin.

2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F 547 where applicable.

2.8 ADHESIVES, CAULKS, AND SEALANTS

2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use polyvinyl acetate resin emulsion. Adhesives shall withstand a bond test as described in WDMA I.S. 1-A.

2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be adhesive consistent with AWI and laminate manufacturer's recommendations. PVC edgebanding shall be adhered using a polymer-based hot melt glue.

2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

2.9 WOOD FINISHES

Paint, stain, varnish and their applications required for laminate clad casework components shall be as indicated in Section 09 90 00 PAINTS AND COATINGS. Color and location shall be as indicated on the drawings.

2.10 ACCESSORIES

2.10.1 Grommets

Grommets shall be plastic material for cutouts with a diameter of 2 inches. Locations shall be as indicated on the drawings.

2.11 FABRICATION

Verify field measurements as indicated in the shop drawings before fabrication. Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI premium grade unless otherwise indicated in this specification. Cabinet style, in accordance with AWI Qual Stds, Section 400-G descriptions, shall be as indicated on the drawings.

2.11.1 Base and Wall Cabinet Case Body

2.11.1.1 Cabinet Components

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

a. Body Members (Ends, Divisions, Bottoms, and Tops): 3/4 inch veneer core plywood panel product.

b. Face Frames and Rails: 3/4 inch hardwood lumber.

c. Shelving: 3/4 inch medium density fiberboard (MDF) panel product.

d. Cabinet Backs: 1/4 inch veneer core plywood panel product.

e. Drawer Sides, Backs, and Subfronts: 1/2 inch panel product.

f. Drawer Bottoms: 1/4 inch veneer core plywood panel product.

g. Door and Drawer Fronts: 3/4-inch medium density fiberboard (MDF) panel product.

2.11.1.2 Joinery Method for Case Body Members

a. Tops, Exposed Ends, and Bottoms.

(1) Steel "European" assembly screws (1-1/2 inch from end, 5 inch on center, fasteners will not be visible on exposed parts).

(2) Doweled, glued under pressure (approx. 4 dowels per 12 inches of joint).

(3) Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).

b. Exposed End Corner and Face Frame Attachment.

(1) For mitered joint: lock miter or spline or biscuit, glued under pressure (no visible fasteners).

(2) For non-mitered joint (90 degree): butt joint glued under pressure (no visible fasteners).

c. Cabinet Backs (Wall Hung Cabinets): Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

(1) Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.

d. Cabinet Backs (Floor Standing Cabinets).

(1) Side bound, captured in grooves; glued and fastened to top and bottom.

e. Wall Anchor Strips shall be required for all cabinets with backs less than 1/2 inch thick. Strips shall consist of minimum 1/2 inch thick lumber, minimum 2-1/2 inches width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

2.11.2 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from 3/4 inch medium density fiberboard (MDF. All door and drawer front edges shall be surfaced with high pressure plastic laminate, color and pattern to match exterior face laminate as indicated on the drawings.

2.11.3 Drawer Assembly

2.11.3.1 Drawer Components

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

b. Drawer Sides and Backs For Laminate Finish: 1/2 inch thick 7-ply hardwood veneer core substrate.

c. Drawer Sides and Back For Thermoset Decorative Overlay (melamine) Finish: 1/2 inch thick medium density particleboard or MDF fiberboard substrate.

d. Drawer Bottom: 1/4 inch thick thermoset decorative overlay melamine panel product.

2.11.3.2 Drawer Assembly Joinery Method

a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.

b. Doweled, glued under pressure.

2.11.4 Shelving

2.11.4.1 General Requirements

Shelving shall be fabricated from 3/4 inch medium density fiberboard MDF. All shelving top and bottom surfaces shall be finished with HPDL plastic laminate or thermoset decorative overlay (melamine). Shelf edges shall be finished in a HPDL plastic laminate or thermoset decorative overlay (melamine).

2.11.4.2 Shelf Support System

The shelf support system shall be:

a. Recessed (mortised) metal shelf standards. Standards shall be mortised flush with the finishes surface of the cabinet interior side walls, two per side. Standards shall be positioned and spaced on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Standards shall be installed and adjusted vertically to provide a level, stable shelf surface when clips are in place.

2.11.5 Laminate Clad Countertops

Laminate countertop substrate shall be constructed of 3/4 inch medium density fiberboard (MDF). The substrate shall be moisture-resistant where countertops receive sinks, lavatories, or are subjected to liquids. All substrates shall have sink cutout edges sealed with appropriate sealant against moisture. No joints shall occur at any cutouts. A balanced backer sheet is required.

2.11.5.1 Edge Style

Front and exposed side countertop edges shall be in shapes and to dimensions as shown on the drawings. The countertop edge material shall be:

a. Post formed plastic laminate. Laminate edge shall be integral with countertop surface. Shape and profile shall be as indicated on the drawings and to dimensions as indicated on the drawings.

2.11.5.2 Laminate Clad Splashes

Countertop splash substrate shall be 3/4 inch MDF fiberboard. Laminate clad backsplash shall be loose, to be installed at the time of countertop installation. Side splashes shall be straight profile and provided loose, to be installed at the time of countertop installation. Back and side splash laminate pattern and color shall match the adjacent countertop laminate.

2.11.6 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and ANSI/NEMA LD 3, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

a. Base/Wall Cabinet Case Body.

(1) Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGP.

(2) Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: HPDL Grade CLS, Thermoset Decorative Overlay (melamine).

b. Adjustable Shelving.

(1) Top and bottom surfaces: HPDL Grade HGS.

(2) All edges: HPDL Grade VGS.

c. Fixed Shelving.

(1) Top and bottom surfaces: HPDL Grade HGS.

(2) Exposed edges: HPDL Grade VGS.

d. Door, Drawer Fronts, Access Panels.

(1) Exterior (exposed) and interior (semi-exposed) faces: HPDL Grade VGP

(2) Edges: HPDL Grade VGS.

e. Drawer Assembly.

All interior and exterior surfaces: HPDL Grade CLS, Thermoset Decorative Overlay (melamine).

f. Countertops and Splashes: All exposed and semi-exposed surfaces: HPDL Grade HGS

g. Tolerances: Flushness, flatness, and joint tolerances of laminated surfaces shall meet the AWI Qual Stds premium grade requirements.

2.11.7 Finishing

2.11.7.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

2.11.7.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

2.11.7.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings and Section 09 90 00 PAINTS AND COATINGS. All cabinet reveals shall be painted. Submit descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with AWI Qual Stds for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall comply with applicable requirements for AWI Qual Stds premium quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

3.1.1 Anchoring Systems

3.1.1.1 Floor

Base cabinets shall utilize a floor anchoring system. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abuts a wall surface, anchoring shall include a minimum 1/2 inch thick lumber or panel product hanging strip, minimum 2-1/2 inch width; securely attached to the top of the wall side of the cabinet back.

3.1.1.2 Wall

Cabinet to be wall mounted shall utilize minimum 1/2 inch thick lumber or panel product hanging strips, minimum 2-1/2 inch width; securely attached to the wall side of the cabinet back, both top and bottom.

3.1.2 Countertops

Countertops shall be installed in locations as indicated on the drawings. Countertops shall be fastened to supporting casework structure with mechanical fasteners, hidden from view. All joints formed by the countertop or countertop splash and adjacent wall surfaces shall be filled with a clear silicone caulk. Loose back and side splashes shall be adhered to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Joints between the countertop surface and splash shall be filled with clear silicone caulk in a smooth consistent concave bead. Bead size shall be the minimum necessary to fill the joint and any surrounding voids or cracks.

3.1.3 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 3/16 inch "Euroscrews". The use of wood screws without insertion dowels is prohibited.

3.1.4 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI Qual Stds premium grade requirements.

3.1.5 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.6 Glass

Install glass and glazing in the casework using methods and materials specified in Section 08 81 00 GLAZING in locations as indicated on the drawings.

-- End of Section --

SECTION 06 61 16

SOLID POLYMER (SOLID SURFACING) FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2583	(2007) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 570	(1998; R 2010e1) Standard Test Method for Water Absorption of Plastics
ASTM D 638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D 696	(2008) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 21	(2009) Determining Resistance of Synthetic Polymeric Materials to Fungi

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO Z124.3	(2005) Plastic Lavatories
IAPMO Z124.6	(2007) Plastic Sinks

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

NSF INTERNATIONAL (NSF)

NSF/ANSI 51	(2009e) Food Equipment Materials

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS Scientific Certification Systems (SCS)Indoor Advantage

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk (2010) Handbook for Ceramic Tile Installation

1.2 SYSTEM DESCRIPTION

a. Work under this section includes countertops, window stools, and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.

b. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.

c. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus 1/4 inch.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Solid polymer material
Fabrications

SD-04 Samples

Material;
Countertops;

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

1.6 WARRANTY

Provide manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

PART 2 PRODUCTS

2.1 MATERIAL

Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting IAPMO Z124.3 and IAPMO Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 1/4 inch in thickness. Submit a minimum 4 by 4 inch sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work.

2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4000 psi (min.)	ASTM D 638
Hardness	55-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303

1/4" sheet	36", 1/2 lb ball, no failure	
1/2" sheet	140", 1/2 lb ball, no failure	
3/4" sheet	200", 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.1% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	30 max	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.2 Acrylic-modified Polymer Solid Surfacing Material

Cast, solid polymer material shall be composed of a formulation containing acrylic and polyester polymers, mineral fillers, and pigments. Acrylic polymer content shall be not less than 5 percent and not more than 10 percent in order to meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4100 psi (min.)	ASTM D 638
Hardness	50-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4" sheet	36", 1/2 lb ball, no failure	
1/2" sheet	140", 1/2 lb	

	ball, no failure	
3/4" sheet	200", 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 21
Liquid Absorption (Weight in 24 hrs.)	0.6% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	100 max	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.3 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project color schedule. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.4 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting TCA Hdbk, Underwriter's Laboratories (UL) listed. Use this adhesive to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Use sealant to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 4 mils thick, applied around the edges of cut outs containing hot or cold appliances.

2.2.5 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

2.3.1 Joints and Seams

Form joints and seams between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Counter and Vanity Top Splashes

Fabricate backsplashes and end splashes from 3/4 inch thick solid surfacing material to be 4 inches high. Backsplashes and end splashes shall be provided for all counter tops. Backsplashes shall be shop fabricated and be permanently attached.

2.3.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition.

2.3.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Window Stools

Fabricate window stools from 3/4 inch thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings and selected from manufacturer's available pre-fabricated standards.

2.3.5 Countertops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 3/4 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high permanently attached, 90 degree transition. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

2.3.6 Solid Polymer Sinks

Solid polymer sinks shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer countertops. Sinks shall be of the same polymer composition as the adjoining counter top.Sink design shall support a seam adhesive undermount installation method. Sinks shall be a double bowl configuration. Sink dimensions shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.1.1 Loose Counter Top Splashes

Mount loose splashes in the locations noted on the drawings. Loose splashes shall be adhered to the counter top with a color matched silicone sealant when the solid polymer components are solid colors. Use a clear silicone sealant to provide adhesion of particulate patterned solid polymer splashes to counter tops.

3.1.2 Silicone Sealant

Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost.

-- End of Section --

SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4263	(1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4479	(2000) Asphalt Roof Coatings - Asbestos Free
ASTM D 449	(2003) Asphalt Used in Dampproofing and Waterproofing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction

1.2 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing manufacturer's original labels. Labels shall include date of manufacture, contents of each container, performance standards that apply to the contents and recommended shelf life.

1.3 SAFETY AND HEALTH REQUIREMENTS

If coal-tar pitch materials are used, the Contractor shall conform to all OSHA 29 CFR 1926 and General Industry Health Standards as well as state and local standards.

PART 2 PRODUCTS

2.1 ASPHALT

ASTM D 449, Type I or Type II.

2.2 ASPHALT PRIMER

ASTM D 41.

2.3 FIBROUS ASPHALT

ASTM D 4479, Type I for horizontal surfaces, Type II for vertical surfaces.

2.4 SURFACE PROTECTION

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with ASTM D 4263. If test indicates moisture, allow a minimum of 7 additional days after test completion for curing. If moisture still exists, redo test until substrate is dry.

3.2 APPLICATION

Prime surfaces to receive asphaltic dampproofing unless recommended otherwise by dampproofing materials manufacturer. Apply dampproofing after priming coat is dry, but prior to any deterioration of primed surface, and when ambient temperature is above 40 degrees F.

3.2.1 Surface Priming

Prime surfaces to receive fibrous asphalt dampproofing with asphalt primer. Apply primer when ambient temperature is above 40 degrees F and at rate of approximately one gallon per 100 square feet, fully covering entire surface to be dampproofed.

3.2.2 Cold-Application Method

Apply two coats of fibrous asphalt to surfaces to be dampproofed. Apply each coat uniformly using not less than one gallon fibrous asphalt per 50 square feet. Apply first coat by brush or spray to provide full bond with primed surface. Brush or spray second coat over thoroughly dry first coat unless recommended otherwise by dampproofing materials manufacturer. Provide finished surface that is of uniform thickness and impervious to moisture. Recoat porous areas.

-- End of Section --

SECTION 07 21 16 MINERAL

FIBER BLANKET INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2005) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 3833/D 3833M	(1996; R 2006) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM E 136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2009; TIA 10-3) National Fuel Gas Code
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket insulation;

Vapor retarder;

Pressure sensitive tape

Accessories

SD-08 Manufacturer's Instructions

Insulation

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Smoking

Do not smoke during installation of blanket thermal insulation.

1.5.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C665, Type I, blankets without membrane coverings ; Class A, membrane-faced surface with a flame spread of 25 or less, except a flame spread rating of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84.

2.1.1 Thermal Resistance Value (R-VALUE)

As indicated

2.1.2 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section. The minimum required recycled materials content by weight are:

Rock Wool: 75 percent slag
Fiberglass: 20 to 25 percent glass cullet

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

2.2 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E 136 for blocking around chimneys and heat producing devices.

2.3 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D 3833/D 3833M.

2.4 ACCESSORIES

2.4.1 Adhesive

As recommended by the insulation manufacturer.

2.4.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.4.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.

b. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

c. Gas Fired Appliances: Clearances as required in NFPA 54.

d. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E 136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

3.3.1.5 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

-- End of Section --

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1289	(2007) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 208	(1995; R 2001) Cellulosic Fiber Insulating Board
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2005) Approval Guide
FM P7825c	(2005) Approval Guide Building Materials
FM P9513	(2002) Specialist Data Book Set for Roofing Contractors; contains 1-22 (2001), 1-28 (2002), 1-29 (2002), 1-28R/1-29R (1998), 1-30 (2000), 1-31 (2000), 1-32 (2000), 1-33 (2000), 1-34 (2001), 1-49 (2000), 1-52 (2000), 1-54 (2001)

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2007) Building Materials Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wood nailers

Tapered roof insulation system;

Show location and spacing of wood nailers that are required for securing insulation and for backnailing of roofing felts. Show a complete description of the procedures for the installation of each phase of the system indicating the type of materials, thicknesses, identity codes, sequence of laying insulation, location of ridges and valleys, special methods for cutting and fitting of insulation, and special precautions. The drawings shall be based on field measurements.

SD-03 Product Data

Fasteners

Insulation;

Include minimum thickness of insulation for steel and concrete decks and fastener pattern for insulation on steel decks.

SD-06 Test Reports

Flame spread and smoke developed ratings

Submit in accordance with ASTM E 84.

SD-07 Certificates

Installer qualifications

SD-08 Manufacturer's Instructions

Nails and fasteners

Roof insulation, including field of roof and perimeter attachment requirements.

1.3 MANUFACTURER'S CERTIFICATE

Submit certificate from the insulation manufacturer attesting that the installer has the proper qualifications for installing tapered roof insulation systems.

Certificate attesting that the polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.4 QUALITY ASSURANCE

1.4.1 Insulation on Steel Decks

Roof insulation shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when

tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Bld Mat Dir as meeting the flame spread and smoke developed ratings will be accepted in lieu of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Bld Mat Dir or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials to site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

a. Name of manufacturer;

b. Brand designation;

c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification; and

d. Asphalt's flashpoint (FP), equiviscous temperature (EVT), and finished blowing temperature (FBT).

Deliver materials in sufficient quantity to allow continuity of the work.

1.5.2 Storage and Handling

Store and handle materials in a manner to protect from damage, exposure to open flame or other ignition sources, and from wetting, condensation or moisture absorption. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Store felt rolls on ends. For the 24 hours immediately before application of felts, store felts in an area maintained at a temperature no lower than 50 degrees F above grade and having ventilation around all sides. Replace damaged material with new material.

1.6 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

1.7 PROTECTION OF PROPERTY

1.7.1 Flame-Heated Equipment

Locate and use flame-heated equipment so as not to endanger the structure or other materials on the site or adjacent property. Do not place flame-heated equipment on the roof. Provide and maintain a fire extinguisher near each item of flame-heated equipment.

1.7.2 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings at least 6 inches, secure them against wind, and vent them to prevent collection of moisture on the covered surfaces. Keep protective coverings in place for the duration of the work with asphalt products.

1.7.3 Special Protection

Provide special protection approved by the insulation manufacturer, or avoid heavy traffic on completed work when ambient temperature is above 80 degrees F.

1.7.4 Drippage of Bitumen

Seal joints in and at edges of deck as necessary to prevent drippage of asphalt into building or down exterior walls.

PART 2 PRODUCTS

2.1 INSULATION

2.1.1 Insulation Types

Roof insulation shall be of the following materials and compatible with attachment methods for the specified insulation and roof membrane:

a. Polyisocyanurate Board: ASTM C 1289 Type II, Class 1 or 2, Grade 2 or 3 fibrous felt or glass mat membrane both sides, except minimum compressive strength shall be 20 pounds per square inch (psi).

ASTM C 208 Type II, Grade 1 or 2, roof insulating overlay/cover board, treated with sizing, wax or bituminous impregnation. Bituminous impregnation shall be limited to 4 percent by weight when used over steel decks. Maximum board size: 4 feet by 4 feet.

2.1.2 Recovered Materials

Provide thermal insulation materials containing recycled materials to the extent practical. The required minimum recycled material content for the listed materials are:

Polyisocyanurate: 9 percent recovered material

2.1.3 Insulation Thickness

As necessary to provide a thermal resistance (R value) of 30 or more at metal roof panels except for exterior canopies. Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

2.1.4 Tapered Roof Insulation

One layer of the tapered roof insulation assembly shall be factory tapered to a slope of not less than 1/4 inch per foot. Provide starter and filler blocks as required to provide the total thickness of insulation necessary to meet the specified slope and thermal conductance. Mitered joints shall be factory fabricated and shall consist of two diagonally cut boards or one board shaped to provide the required slopes. Identify each piece of tapered

insulation board by color or other identity coding system, allowing the identification of different sizes of tapered insulation board required to complete the roof insulation system.

2.1.5 Cants and Tapered Edge Strips

Provide preformed cants and tapered edge strips of the same material as the roof insulation; or, when roof insulation material is unavailable, provide pressure-preservative treated wood, wood fiberboard, or rigid perlite board cants and edge strips as recommended by the roofing manufacturer, unless otherwise indicated. Face of cant strips shall have incline of 45 degrees and vertical height of 4 inches. Taper edge strips at a rate of one to 1 1/2 inch per foot down to approximately 1/8 inch thick.

2.2 PROTECTION BOARD

For use as a thermal barrier (underlayment), fire barrier (overlayment), or protection board for hot-mopped, torched-down, or adhesively-applied roofing membrane over roof insulation.

2.2.1 Fiberboard

a. Wood Fiberboard: ASTM C 208, high density, except 4 by 4 feet maximum board size.

2.3 BITUMENS

2.3.1 Asphalt Primer

ASTM D 41.

2.3.2 Asphalt

ASTM D 312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and for mechanical spreader application shall be indicated on bills of lading or on individual containers.

2.3.3 Asphalt Roof Cement

ASTM D 4586, Type I for horizontal surfaces and for surfaces sloped from 0 to 3 inches per foot, Type II for vertical and surfaces sloped more than 3 inches per foot.

2.4 FASTENERS

Flush-driven through flat round or hexagonal steel or plastic plates. Steel plates shall be zinc-coated, flat round not less than 1 3/8 inch diameter or hexagonal not less than 28 gage. Plastic plates shall be high-density, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fastener head shall recess fully into the plastic plate after it is driven. Plates shall be formed to prevent dishing. Do not use bell-or cup-shaped plates.

2.4.1 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws conforming to FM AS 4470 and listed in FM P7825c for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of 90 psf conforming to FM P7825.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

3.1.1 Surface Inspection

Surfaces shall be clean, smooth, and dry. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The Contractor shall inspect and approve the surfaces immediately before starting installation. Prior to installing insulation, perform the following:

a. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.

3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage and hollow or low spots and perform the following:

a. Install wood nailers the same thickness as insulation at eaves, edges, curbs, walls, and roof openings for securing cant strips, gravel stops, gutters, and flashing flanges. On decks with slopes of one inch per foot or more, install wood nailers perpendicular to slope for securing insulation. Space nailers in accordance with approved shop drawings.

b. Cover steel decks with a layer of insulation board of sufficient thickness to span the width of a deck rib opening, and conforming to fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement conforming to FM P7825. Insulation joints parallel to ribs of deck shall occur on solid bearing surfaces only, not over open ribs.

3.2 INSULATION INSTALLATION

Apply insulation in multiple layers with staggered joints when total required thickness of insulation exceeds 2 inches. Lay insulation so that continuous longitudinal joints are perpendicular to direction of roofing, as specified in Section 07 52 00, "MODIFIED BITUMINOUS MEMBRANE ROOFING", and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, joints of each succeeding layer shall be parallel and offset in both directions with respect to layer below. Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface.

3.2.1 Special Precautions for Installation of Foam Insulation

3.2.1.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, mechanically fasten bottom 1 1/2 inch insulation layer max. board size = 4'x8". Provide bottom layer compliant with manufacturer's requirements for uplift indicated. Adhere upper layer(s), max. board size = 4'x4". Install 1/2 inch thick wood fiberboard over top surface of foam board insulation where modified bitumen roof membrane systems are to be installed. Stagger joints of insulation with respect to foam board insulation below.

3.2.2 Cant Strips

Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof. Wood cant strips shall bear on and be anchored to wood blocking. Fit cant strips flush against vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install in an adhesive approved by insulation manufacturer.

3.2.3 Tapered Edge Strips

Where indicated, provide edge strips in the right angle formed by junction of roof and wood nailing strips that extend above level of roof. Install edge strips flush against vertical surfaces of wood nailing strips. Where possible, nail edge strips to adjoining surfaces. Where installed against non-nailable materials, install in an adhesive approved by insulation manufacturer.

3.3 PROTECTION

3.3.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with the finished roofing specified in Modified Bituminous Membrane Roofing on same day. Do not permit phased construction. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight to conform to indicated live load limits of roof construction. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent.

3.3.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

3.4 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with FM P9513.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION 07 24 00

EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2009) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C1177/C1177M	(2008) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1186	(2008) Standard Specification for Flat Non-Asbestos Fiber Cement Sheets
ASTM C1278/C1278M	(2007a) Standard Specification for Fiber-Reinforced Gypsum Panel
ASTM C473	(2010) Physical Testing of Gypsum Panel Products
ASTM C578	(2011) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C67	(2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C847	(2010a) Standard Specification for Metal Lath
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 2247	(2011) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	(2000; R 2005) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D 968	(2005; R 2010) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 2098	(2000; R 2006) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and

	Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 695	(2003; R 2009) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 153	(2004; R 2010) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)

EIMA TM 101.01	(1995) Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS), Class PB
EIMA TM 101.86	(1995) Resistance of Exterior Insulation Finish Systems (EIFS), Class PB to The Effects of Rapid Deformation (Impact)

INTERNATIONAL CODE COUNCIL (ICC)

ICC UBC	(1997; Erratas Vol 1, 2 & 3 01/2001; Vol 1 & 2 03/2001; Vol 2 10/2001) Uniform Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268	(2007) Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of sheathing, insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components shall be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials shall be installed by an applicator approved by the system manufacturer. EIFS shall be Class PB as indicated and shall be color and finish as indicated.

1.2.1 System Requirements and Tests

The system shall meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E 331. There shall be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.4 psf, or 20 percent of positive design wind pressure, whichever is greater.

1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with ASTM E 330 (procedure A) to a minimum pressure of 45 psf. There shall be no permanent deformation, delamination, or other deterioration.

1.2.1.3 Full scale or intermediate scale fire test

Conduct wall fire test using apparatus, specimen, performance criteria, and procedure in accordance with ICC UBC, Chapter 26-4. The specimen shall include the complete system using 4 inch thick insulation board. At the option of the contractor, ICC UBC, Chapter 26-9, Intermediate-Scale Test may be substituted in lieu of the Full-Scale Multi- Story Fire test. The following requirements shall be met:

a. No vertical spread of flame within core of panel from one story to the next.

b. No flame spread over the exterior surface.

c. No vertical flame spread over the interior surface from one story to the next.

d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

1.2.2 Component Requirements and Tests

The components of the system shall meet the performance requirements as verified by the tests listed below.

1.2.2.1 Surface Burning Characteristics

Conduct ASTM E 84 test on samples consisting of base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index shall be 25 or less and the smoke developed index shall be 450 or less.

1.2.2.2 Radiant Heat

The system shall be tested in accordance with NFPA 268 on both the minimum and maximum thickness of insulation intended for use with no ignition during the 20-minute period.

1.2.2.3 Impact Resistance

a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with EIMA TM 101.86. The test specimen shall exhibit no broken reinforcing fabric per EIMA TM 101.86 at an impact of 150 in/lb.

b. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with ASTM E 695. The test specimen shall exhibit no cracking or denting after twelve impacts by 30 lbs lead shot mass from 6 in to 6 ft drop heights in 6 in intervals.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building. For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D 968, Method A. Test a minimum of two specimens. After testing, the specimens shall show only very slight smoothing, with no loss of film integrity after 132 gallons of sand.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G 153, Cycle 1. After 2000 hours specimens shall exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D 3273. The specimen shall consist of the finish coat material, applied to clean 3 inch by 4 inch glass slides and shall be allowed to cure for 28 days. After 28 days of exposure, the specimen shall not show any growth.

1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B117. The specimen shall be a minimum of 4 inch by 6 inch and shall be tested for a minimum of 300 hours. After exposure, the specimen shall exhibit no observable deterioration, such as chalking, fading, or rust staining.

1.2.3.5 Water Resistance

Test in accordance with ASTM D 2247. The specimen shall be a minimum of 4 inch by 6 inch. After 14 days, the specimen shall exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.6 Absorption-Freeze/Thaw

Class PB systems shall be tested in accordance with EIMA TM 101.01 for 60 cycles of freezing and thawing. No cracking, checking, or splitting, and

negligible weight gain. Class PM systems shall be tested in accordance with ASTM C67 for 50 cycles of freezing and thawing. After testing, the specimens shall exhibit no cracking or checking and have negligible weight gain.

1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component 12 by 24 inches, on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

1.2.4 Moisture Analysis

Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop drawings;

Show wall layout, construction and expansion joints, decorative grooves, layout of sheathing board, thermal insulation board, and reinforcing mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; details at windows and or doors; and details at base, roof and corners.

SD-03 Product Data

Sheathing board;

Thermal insulation;

Mechanical Fasteners;

Reinforcing fabric

Finish coat

Joint Sealant

Sealant Primer

Bond breaker

Backer Rod

Insulation Board

Warranty

Include joint and other details, such as end conditions, corners, windows, and parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include material safety data sheets (MSDS)for all components of the EIFS. The MSDS shall be available at the job site.

SD-04 Samples

Sample Boards;

Color and Texture

SD-05 Design Data

Wind load Calculations;

SD-06 Test Reports

Abrasion resistance

Accelerated weathering

Impact resistance

Mildew resistance Salt

spray resistance

Water vapor transmission

Absorption-freeze-thaw

Wall fire test

Water penetration

Water resistance

Surface Burning Characteristics

Radiant heat

Wind load

SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of EIFS Manufacturer

The EIFS shall be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

The EIFS Installer shall be trained by the EIFS manufacturer to perform the installation of the System and shall have successfully installed at least five projects at or near the size and complexity of this project. The contractor shall employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator shall be experienced and competent in the installation of high performance industrial and commercial sealants and shall have successfully installed at least five projects at or near the size and complexity of this project.

1.4.5 Insulation Board

Insulation Board shall be approved and labeled under third party quality program as required by applicable building code.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

1.6 ENVIRONMENTAL CONDITIONS

a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.

b. Apply sealants and wet materials only at ambient temperatures of 40 degrees F or above and rising, unless supplemental heat is provided. The system shall be protected from inclement weather and to maintain this temperature for a minimum of 24 hours after installation.

c. Do not leave insulation board exposed to sunlight after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty shall run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 SHEATHING BOARD

2.2.1 Fiber Reinforced Cement Sheathing Board

a. Meet ASTM C1186, Type A, Grade I.

b. Non-combustible per ASTM E 136.

c. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

d. Thickness no less than 1/2 inch.

e. Water Absorption not to exceed 17 percent.

2.2.2 Glass Mat Gypsum Sheathing Board

a. Conform to ASTM C1177/C1177M; or.

b. ASTM C1278/C1278M, Water Resistant Exterior Type only

c. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

2.3 ADHESIVE

Manufacturer's standard product, including primer as required, and shall be compatible with substrate and insulation board to which the system is applied.

2.4 LATHING AND FURRING

Conform to ASTM C847, 2.5 lb/sq yd, self-furring, galvanized.

2.5 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.6 THERMAL INSULATION

2.6.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

2.6.2 Insulation Board

Insulation board shall be standard product of manufacturer and shall be compatible with other systems components. Boards shall be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degree F, and thickness. No layer of insulation shall be less than 3/4 inch thick. The maximum thickness of all layers shall not exceed 4 inches Insulation Board shall be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

a. Thermal resistance: As indicated

b. Insulating material: ASTM C578 Type I as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.

c. Drainage: Preform channels into the interior face of insulation board or provide polypropylene drainage lath spacer to provide water drainage system.

2.7 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.8 REINFORCING FABRIC

Reinforcing fabric mesh shall be alkali-resistant, balanced, open weave , glass fiber fabric made from twisted multi-end strands specifically treated

for compatibility with the other system materials, and comply with ASTM E 2098 and as recommended by EIFS manufacturer.

2.9 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

2.10 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.11 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, expansion joints. All metal items and fasteners to be corrosion resistant.

2.12 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C920, as Type S or M, minimum Grade NS, minimum Class 25 and compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.13 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.14 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface shall be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate shall be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge.Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation

instructions but provide a flatness of not more that 1/4 inch in 10 feet. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor shall not proceed with the installation until all noted deficiencies of the substrate are corrected.

3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS shall be installed only by an applicator trained by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations.

3.3.1 Sheathing Board

Edges and ends of boards shall be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board to metal panels and girts with self-tapping drywall screws. Place fasteners sufficiently close to support imposed loads, but not more than:

a. Maximum of 8 inches apart on each supporting stud

Space fasteners more closely when required for negative wind load resistance.

3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least 8 inches. Align drainage channels of integral drainage system or provide polypropylene drainage lath space to provide a path for any water weeped from behind the insulation to escape wall construction. Use L-shaped insulation board pieces at corners of openings. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Gaps greater than 1/16 inch between the insulation boards shall be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than 1/16 inch shall be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board shall be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

3.3.2.1 Mechanically Fastened Insulation Boards

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 2 feet horizontally and vertically.

3.3.2.2 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer's instructions.

3.3.3 Base Coat and Reinforcing Fabric Mesh,

3.3.3.1 Class PB Systems

Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with manufacturer's instructions. Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh shall not be visible. Provide diagonal reinforcement at opening corners. Back-wrap or edge wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 2.5 inches on previously installed mesh, or butted, in accordance with the manufacturer's instructions.

3.3.4 Finish Coat

The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., shall be corrected prior to the application of the finish coat. Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved sample. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat shall be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied.

3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat or base coat with EIFS Manufacturer's color coating. Do not apply sealant to the finish coat.

3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 0.5 inch for perimeter seals and 0.75 inch for expansion joints. The width shall not be less than 4 times the anticipated movement. Check

sealant manufacturer's recommendations regarding proper width to depth ratio.

3.4.2 Sealant

Do not apply sealant until all EIFS coatings are fully dry. Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or can not be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor shall establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance shall be removed and replaced or corrected in an approved manner.

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

SECTION 07 41 13

METAL ROOF PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341	(2005; Supp 2001) Seismic Provisions for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002) Cold-Formed Steel Design Manual Set
AISI/COS/NASPEC	(2001, Supplement 2004) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7-05	(2006) Minimum Design Loads for Buildings and Other Structures, Including Supplement No. 1

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M	(2004; Errata 2004) Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2006; Errata 2006) Structural Welding Code - Steel
AWS D1.2/D1.2M	(2003; Errata 2004) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M	(2007a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel

ASTM A 653/A 653M	(2007) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 755/A 755M	(2003) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A 792/A 792M	(2006a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A 924/A 924M	(2007) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 792	(2004) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1308	(2002; R 2007) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1667	(2005) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 1970	(2001) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D 2244	(2007) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2447	(2003) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter

ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 3363	(2005) Film Hardness by Pencil Test
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	(2005) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Standard Test Method for Specular Gloss
ASTM D 5894	(2005) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(2007) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002e1) Evaluating Degree of Blistering of Paints
ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 968	(2005e1) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 2140	(2001) Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

FM GLOBAL (FM)

FM 4471	(1995) Class I Panel Roofs

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA RSDM	(2000) Metal Roofing Systems Design Manual

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0405	(2001; R 2003, 5th Ed) Roofing and Waterproofing Manual
NRCA ASMMRM	(2006) Architectural Sheet Metal and Metal Roofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2006) Architectural Sheet Metal Manual, Sixth Edition, Second Printing

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 12	(1982; E 2000) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-28578	(Rev B; CANC Notice 1) Paint, Water-Borne, Acrylic or Modified Acrylic, Semi-Gloss, for Metal Surfaces

UNDERWRITERS LABORATORIES (UL)

UL 580	(2006) Tests for Uplift Resistance of Roof Assemblies
UL Bld Mat Dir	(2007) Building Materials Directory

1.2 DESCRIPTION OF METAL ROOF SYSTEM

1.2.1 Performance Requirements

Steel panels and accessory components must conform to the following standards:

ASTM A 1008/A 1008M
ASTM A 123/A 123M
ASTM A 36/A 36M
ASTM A 755/A 755M for metallic coated steel sheet for exterior coil prepainted applications.
ASTM A 924/A 924M for metallic coated steel sheet
ASTM D 522 for applied coatings
UL Bld Mat Dir

1.2.1.1 Hydrostatic Head Resistance

No water penetration when tested according to ASTM E 2140. Submit leakage test report upon completion of installation.

1.2.1.2 Wind Uplift Resistance

Provide metal roof panel system that conform to the requirements of ASTM E 1592 and UL 580. Uplift force due to wind action governs the design for panels. Submit wind uplift test report prior to commencing installation.

Roof system and attachments must resist the wind loads as determined by ASCI/SEI 7-05, in pounds per square foot. Metal roof panels and component materials must also comply with the requirements in FM 4471 as part of a panel roofing system as listed in Factory Mutual Guide (FMG) "Approval Guide" for class 1 or noncombustible construction, as applicable. Identify all materials with FMG markings.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing Panels;

Flashing and Accessories;

Gutter/Downspout Assembly;

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Roof panels;

FACTORY-APPLIED COLOR FINISH;

Accessories;

Fasteners;

Pressure Sensitive Tape;

UNDERLAYMENTS; ice and water shield

Gaskets and Sealing/Insulating Compounds;

Enamel Repair Paint;

Galvanizing Repair Paint; G

SD-04 Samples

Roof Panels;

Factory-applied Color Finish, samples, 9 inch lengths, full width;

Accessories;

Fasteners;

Gaskets and Sealant/Insulating Compounds;

SD-05 Design Data

Wind Uplift Resistance;

SD-06 Test Reports

Leakage Test Report;

Wind Uplift Test Report;

Fire Rating Test Report;

Factory Finish and Color Performance Requirements;

SD-07 Certificates

Roof Panels;

Self-Adhering Polyethylene Film Ice and Water Shield Underlayment;

Qualification of Manufacturer;

Qualification of Applicator;

SD-08 Manufacturer's Instructions

INSULATION;

INSTALLATION MANUAL;

SD-09 Manufacturer's Field Reports

Manufacturer's Field Inspection Reports;

SD-11 Closeout Submittals

Warranties;

Information Card;

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

Submit documentation verifying metal roof panel manufacturer has been in the business of manufacturing metal roof panels for a period of not less than 5 years.

Manufacturer must also provide engineering services by an authorized engineer, currently licensed in the geographic area of the project, with a minimum of five (5) years experience as an engineer knowledgeable in roof wind design analysis, protocols and procedures for MBMA RSDM, ASCE/SEI 7-05, UL 580, and FM 4471. Engineer must provide certified engineering calculations for the project conforming to the stated references.

1.4.1.1 Manufacturer's Technical Representative

The manufacturer's technical representative must be thoroughly familiar with the products to be installed, installation requirements and practices, and with any special considerations in the geographical area of the project. The representative must perform field inspections and attend meetings as specified.

1.4.1.2 Single Source

Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer, and the most recent design of the manufacturer to operate as a complete system for the intended use.

1.4.2 Qualification of Applicator

Metal roof system applicator must be approved, authorized, or licensed in writing by the roof panel manufacturer and have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer, approved at a level capable of providing the specified warranty. Supply the names, locations and client contact information of 5 projects of similar size and scope constructed by applicator using the manufacturer's roofing products submitted for this project within the previous three years.

1.4.3 Field Verification

Prior to the preparation of drawings and fabrication, verify location of roof framing, roof openings and penetrations, and any other special conditions. Indicate all special conditions and measurements on final shop drawings.

1.4.4 Qualifications for Welding Work

Welding procedures must conform to AWS D1.1/D1.1Mfor steel or AWS D1.2/D1.2M for aluminum.

Operators are permitted to make only those types of weldments for which each is specifically qualified.

1.4.5 Pre-roofing Conference

After approval of submittals and before performing roofing system installation work, hold a pre-roofing conference to review the following:

a. Drawings, specifications, and submittals related to the roof work. Submit, as a minimum; sample profiles of roofing panels, with factory-applied color finish samples, flashing and accessories, gutter/downspout assembly samples, typical fasteners and pressure sensitive tape, sample gaskets and sealant/insulating compounds. Also include data and 1/2 pint sample of enamel repair paint and galvanizing repair paint, and technical data on factory formed panels, and manufacturer's installation manual.

b. Roof system components installation;

c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;

d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

e. Quality control plan for the roof system installation;

f. Safety requirements.

Coordinate pre-roofing conference scheduling with the Contracting Officer. Attendance is mandatory for the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of metal roof system, flashing and sheet metal work, mechanical and electrical work, other trades interfacing with the roof work, and representative of the metal roofing manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.5 DELIVERY, HANDLING, AND STORAGE

Deliver, store, and handle panel materials, bulk roofing products, accessories, and other manufactured items in a manner to prevent damage and deformation, as recommended by the manufacturer, and as specified.

1.5.1 Delivery

Package and deliver materials to the site in undamaged condition. Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use, except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, deformation, dampness, and staining.Remove affected materials from the site and immediately replace.. Remove moisture from wet materials not otherwise affected, restack and protect from further moisture exposure.

1.5.2 Handling

Handle materials in a manner to avoid damage. Select and operate material handling equipment so as not to damage materials or applied roofing.

1.5.3 Storage

Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering which prevents trapping of water or condensation under the covering. Store roof panels so that water which may have accumulated during transit or storage will drain off. Do not store panels in contact with materials that might cause staining. Secure coverings and stored items to protect from wind displacement.

1.6 PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit metal roof panel work to be performed

according to manufacturer's written instructions and warranty requirements, and specified safety requirements.

1.7 FABRICATION

Fabricate and finish metal roof panels and accessories on a factory stationary industrial type rolling mill to the greatest extent possible, per manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements. Comply with indicated profiles, dimensional and structural requirements.

Provide panel profile, as indicated on drawings including major ribs for full length of panel. Fabricate panel side laps with factory installed captive gaskets or separator strips providing a weather tight seal and preventing metal-to metal contact, and minimizing noise from movements within the panel assembly.

1.7.1 Finishes

Finish quality and application processes must conform to the related standards specified within this section. Noticeable variations within the same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize any contrasting variations.

1.7.2 Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 as applicable to the design, dimensions, metal, and other characteristics of the item indicated.

a. Form exposed sheet metal accessories which are free from excessive oil canning, buckling, and tool marks, and are true to line and levels indicated, with exposed edges folded back to form hems.

b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

c. Sealed Joints: Form non-expansion, but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA 1793.

d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

e. Fabricate cleats and attachments devices of size and metal thickness recommended by SMACNA or by metal roof panel manufacturer for application, but not less than the thickness of the metal being secured.

1.8 WARRANTIES

Provide metal roof system material, weather tightness and workmanship warranties meeting specified requirements. Provide revision or amendment to manufacturer's standard warranty as required to comply with the specified requirements.

1.8.1 Metal Roof Panel Manufacturer Warranty

Furnish the metal roof panel manufacturer's 20-year roof system materials and installation workmanship warranty, including flashing, insulation, components, trim, and accessories necessary for a watertight roof system construction. Make warranty directly to the Government, commencing at time of Government's acceptance of the roof work. The warranty must state that:

a. If within the warranty period, the metal roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-weathertight, shows evidence of moisture intrusion within the assembly, displaces, corrodes, perforates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the metal roof system and correction of defective workmanship is the responsibility of the metal roof panel manufacturer. All costs associated with the repair or replacement work are the responsibility of the metal roof panel manufacturer.

b. If the manufacturer or his approved applicator fail to perform the repairs within 48 hours of notification, emergency temporary repairs performed by others does not void the warranty.

1.8.2 Weathertightness Warranty

Metal roof system manufacturer shall submit, for Government review and acceptance, a specimen copy of the manufacturer's Weathertightness Warranty, including evidence of application for warranty and manufacturer's acceptance of the applicator and warranty conditions. Warranty shall be a Single-Source Warranty. The specified warranty requirements and conditions are required to be satisfied, regardless of the manufacturer's standard warranty language or preferences. Roofing payments will be subject to additional withholdings at the Government's discretion pending provision of acceptable executed roofing manufacturer's and Contractor's roofing warranties.

Single Source Warranty: Single Source Warranties require a certified installer on site at all times:

a. For a period of twenty (20) years from the date of substantial completion, the roofing manufacturer WARRANTS to the Building Owner (Owners): to furnish roof panels, flashing and related items used to fasten the roof panels, and flashing including roof jack and curb attachments to the roof structure, will not allow intrusion of water from the exterior of the roofing manufacturer's Roof System into the building envelope when exposed to wind and weather conditions, excluding tornado or hurricane conditions, and ordinary wear and usage. The date of substantial completion is the date that is certified by the Owner's Representative, when the roofing manufacturer's Roofing System is complete and accepted by the Owner. Roofing will not be accepted, nor will any warranty commence, so long as the original roofing installation is not made watertight.

2. Manufacturer's Field Service

a. During installation, provide a minimum of two on-site inspections of roof application by qualified technical representative of the manufacturer.

b. Upon completion of installation, provide final written inspection report by a technical representative of roofing manufacturer to confirm that roofing system has been installed in accordance with manufacturer's requirements.

3. The roofing manufacturer shall have the SOLE AND EXCLUSIVE obligation for all warranty work commencing on the date of roofing substantial completion and under all circumstances terminates on the twenty (20) year anniversary of the date certified as Substantial Completion of the roofing manufacturer's Roof System. During the period in which the roofing manufacturer has any warranty obligation, the roofing manufacturer shall take appropriate actions necessary to cause the non-performing portions of the Roof System to perform their proper functions.

4. Roofing Manufacturer's Liability:

The total liability of the roofing manufacturer under Single Source warranty is a no dollar limit of the manufacturers Roof System as invoiced to the roofing manufacturer's customer.

1.8.3 Manufacturer's Finish Warranty

Provide a manufacturer's 20 year warranty for the roofing system. Issue the warranty directly to the Government at the date of Government acceptance warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244. Installation of the roofing in a coastal environment shall not diminish or void the finish warranty.

1.8.4 Metal Roof System Installer Warranty

Provide roof system installer warranty for a period of not less than two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof panel installation, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Issue warranty directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials is the responsibility of the metal roof system installer. All costs associated with the repair or replacement work are the responsibility of the installer.

1.9 CONFORMANCE AND COMPATIBILITY

The entire metal roofing and flashing system must be in accordance with specified and indicated requirements, including wind resistance and seismic per AISC 341 requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the MBMA RSDM, NRCA 0405, the metal panel manufacturer's published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or

indicated requirements to the Contracting Officer for approval prior to installation.

1.10 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of English unit measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The English units for the measurements shown are as follows:

	PRODUCTS	ENGLISH UNITS
a.	Panels - vertical legs	16/18 inches 2 inches
b.	Screws	No. 14 No. 12
c.	Bolts	1/4 inch
d.	Studs	3/16 inch
e.	Fasteners	1/2 inch One inch
f.	Rivets	1/16 inch 1/8 inch

PART 2 PRODUCTS

2.1 ROOF PANELS

2.1.1 Steel Sheet Panels

Roll-form steel sheet roof panels to the specified profile, with fy = 22 gauge and depth as indicated.
Material must be plumb and true, and within the tolerances listed:

a. Aluminum-Zinc alloy coated steel sheet conforming to ASTM A 792/A 792M and AISI SG03-3.

b. Individual panels to have continuous length sufficient to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not a part of the panel profile and free from damage to the finish coating system.

c. Provide panels with thermal expansion and contraction consistent with the type of system specified, and the following profile.

d. Profile to be a 2 inch high standing seam, 16 or 18 inch coverage with mechanical crimping or snap-together seams with concealed clips and fasteners.

2.2 FACTORY FINISH AND COLOR PERFORMANCE REQUIREMENTS

All panels are to receive a factory applied polyvinylidene fluoride finish consisting of a baked topcoat with a manufacturer's recommended prime coat conforming to the following:

a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with an acid rinse, and thorough drying.

b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 + 0.05 mils. The prime coat must be oven cured prior to application of the finish coat.

c. Exterior Finish Coating: Apply the exterior finish coating over the primer by roll coating to a dry film thickness of 0.80 + 0.05 mils for a total dry film thickness of 1.00 +0.10 mils. This exterior finish coat must be oven-cured.

d. Interior finish coating: Apply a wash coat on the reverse side over primer by roll coating to a dry film thickness of 0.30 + 0.05 mils for a total dry fill thickness of 0.50 +0.10 mils. The wash coat must be oven cured.

e. Color: The exterior finish chosen from the manufacturer's standard color chart.

f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General: SSPC Paint 12, MIL-P-28578, ASTM D 5894, and ASTM D 4587.

Abrasion: ASTM D 968
Adhesion: ASTM D 3359
Chalking: ASTM D 4214
Chemical Pollution: ASTM D 1308
Color Change and Conformity: ASTM D 2244
Creepage: ASTM D 1654
Cyclic Corrosion Test: ASTM D 5894
Flame Spread: ASTM E 84
Flexibility: ASTM D 522
Formability: ASTM D 522
Gloss at 60and 85 degrees: ASTM D 523
Humidity: ASTM D 2247 and ASTM D 714
Oxidation: ASTM D 610
Pencil Hardness: ASTM D 3363
Reverse Impact: ASTM D 2794
Salt Spray: ASTM B 117
Weatherometer: ASTM G 23 and ASTM D 822
ASTM B 117 withstand 2000 hours including scribe requirement. Upon completion of ASTM B 117 test, coating/finish receive rating of 10, no blistering by ASTM D 714 and rating of 7, ASTM D 1654, No. 1.

ASTM G 23/D 2565: accelerated weathering for 2000 hours. No cracking or loss of adhesion.
ASTM D 522: 180 degree bend over 1/8" mandrel; no loss of adhesion or micro-checking.
ASTM D 4214: 2000 hours, no more than No. 8 chalking.
ASTM D 2447: 1000 hours, no signs of blistering, cracking or corrosion
ASTM D 523: 30 plus or minus 5 at 60 degree angle.

2.2.1 Metal Panel System Manufacturer

Provide metal panel system by one of the following manufacturers:

Centria
105 Beaver Grade Road
Moon Township, PA 15108-2944
800-586-1372

McElroy Metals, Inc.
Architectural Products Division
555 Dividend Road
Peachtree City, GA 30269
800-950-6533

2.3 MISCELLANEOUS METAL FRAMING

2.3.1 General

Provide cold formed metallic-coated steel sheet conforming to ASTM A 653/A 653M, AISI/COS/NASPEC, and as specified in 05 40 00 COLD-FORMED METAL FRAMING unless otherwise indicated.

2.3.2 Fasteners and Miscellaneous Metal Framing

Provide compatible type, corrosion resistant, of sufficient size and length to penetrate the supporting element a minimum of one inch with other required properties to fasten miscellaneous metal framing members to substrates in accordance with the roof panel manufacturer's and ASCE/SEI 7-05 requirements.

2.3.2.1 Exposed Fasteners

Fasteners for roof panels must be corrosion resistant coated steel, compatible with the sheet panel or flashing material and of the type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories must be the manufacturer's standard. Provide an integral metal washer, matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick for exposed fasteners.

2.3.2.2 Screws

Provide corrosion resistant screws, coated steel of the type and size recommended by the manufacturer to meet the performance requirements.

2.3.2.3 Attachment Clips

Provide hot-dip galvanized, conforming to ASTM A 653/A 653M, clips. Size, shape, thickness and capacity must meet the thickness and design load criteria specified.

2.3.3 Electrodes for Manual, Shielded Metal Arc Welding

Electrodes for manual, shielded metal arc welding must meet the requirements of AWS D1.1/D1.1M, and be covered, mild-steel electrodes conforming to AWS A5.1/A5.1M.

2.4 ACCESSORIES

Accessories must be compatible with the metal roof panels. Sheet metal flashing, trim, metal closure strips, caps, and similar metal accessories must be not less than the minimum thicknesses specified for roof panels. Provide exposed metal accessories to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips must be closed-cell or solid-cell synthetic rubber or neoprene premolded to match configuration of the panels and not absorb or retain water.

2.4.1 Pre-manufactured Accessories

Pre-manufactured accessories must be manufacturer's standard for intended purpose, comply with applicable specification section, compatible with the metal roof system and approved for use by the metal roof panel manufacturer. Construct curbs to match roof slope.

2.4.2 Metal Closure Strips (Primary Closure)

Provide factory fabricated steel closure strips of the same gauge, color, finish and profile as the specified roof panel.

2.4.3 Rubber Closure Strips (Secondary Closure)

Provide closed-cell, expanded cellular rubber closure strips conforming to ASTM D 1056 and ASTM D 1667, extruded or molded to the configuration of the specified roof panel profile and in lengths supplied by roof panel manufacturer.

2.5 JOINT SEALANTS

2.5.1 Sealants

Sealants are to be an approved gun type for use in hand or air pressure caulking guns at temperatures above 40 degrees F (or frost-free application at temperatures above 10 degrees F) with a minimum solid content of 85 percent of the total volume. Sealant must dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather tight joint. No migratory staining, in conformance with to ASTM C 792, is permitted on painted or unpainted metal, stone, glass, vinyl or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the roof panel manufacturer.

2.5.1.1 Shop Applied Sealants

Sealant for shop-applied caulking must be an approved gun grade, non-sag one-component polysulfide or silicone conforming to ASTM C 792 and ASTM C 920, Type II, with a curing time which ensures the sealants plasticity at the time of field erection. Color to match panel color.

2.5.1.2 Field Applied Sealants

Sealants for field-applied caulking must be an approved gun grade, non-sag on-component polysulfide or two component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to ASTM C 920, Type II. Color to match panel color.

2.5.1.3 Tape Sealants

Provide pressure sensitive, 100 percent solid tape sealant with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof panel manufacturer.

2.5.2 Sheet Metal Flashing and Trim

2.5.2.1 Fabrication, General

Custom fabricate sheet metal flashing and trim to comply with recommendations within the SMACNA 1793 that apply to design, dimensions, metal type, and other characteristics of design indicated. Shop fabricate items to the greatest extent possible. Obtain and verify field measurements for accurate fit prior to shop fabrication. Fabricate flashing and trim without excessive oil canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

2.6 INSULATION

Insulation, facer material and attachment must be compatible with metal roof system specified, as approved by the roof panel manufacturer.

2.6.1 Fire Rated Roof Panel Assembly

Provide materials for fire-rated roof panel construction as follows:

Impaling clips, accessories, and fasteners must be UL listed 40 U18.24 UL Bld Mat Dir galvanized steel sheet or impaling bolts welded to each wall unit joint and spaced not more than 48 inches on center.

Provide bar subgirts 1-1/2- by 1/8 inch galvanized steel with slotted holes for welding to end of impaling clip spikes.

Provide galvanized steel structural angles and flashing angles, gage or thickness as indicated, or material as specified. Flashing angles must be not less than No. 18 U.S. standard gage.

Provide hot-dip galvanized steel metal facing conforming to ASTM A 653/A 653M, Grade A. Coating must conform to, ASTM A 653/A 653M and ASTM A 924/A 924M.

Metal facing must be as indicated and fabricated of enamel-coated hot-dip galvanized steel conforming to ASTM A 653/A 653M, Grade A. Coating must conform to ASTM A 653/A 653M and ASTM A 924/A 924M. Provide Class A fire

hazard classification finish. Flame spread, fuel contributed, or smoke developed cannot exceed a value of 25.

Submit fire rating test report to contracting officer for review and approval. Secure written approval prior to commencement of installation.

2.7 UNDERLAYMENTS

2.7.1 Self-Adhering Polyethylene Film Ice and Water Shield Underlayment

Provide self-adhering polyethylene film membrane ice and water shield underlayment material in compliance with ASTM D 1970, suitable for use as underlayment for metal roofing. Provide 30 mil membrane with tensile strength of 250 PSI, elongation factor of 250%, adhesion to plywood of 3 lb/in width. Permeance (max) of 0.05 perms max and installed material weight of 0.22 lb/sf.

2.8 GASKETS AND SEALING/INSULATING COMPOUNDS

Gaskets and sealing/insulating compounds must be nonabsorptive and suitable for insulating contact points of incompatible materials. Sealing/insulating compounds must be non-running after drying.

2.9 FINISH REPAIR MATERIAL

Repair paint for color finish enameled roofing must be compatible paint of the same formula and color as the specified finish furnished by the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work. Ensure surfaces are suitable, dry and free of defects and projections which might affect the installation.

Examine primary and secondary roof framing to verify that rafters, purlins, angels, channels, and other structural support members for panels and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer, UL, ASTM, and ASCE/SEI-7-05 requirements.

Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking; and that installation is within flatness tolerances required by metal roof panel manufacturer.

Examine rough-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of panels prior to installation.

Submit a written report to the Contracting Officer, endorsed by the installer, listing conditions detrimental to the performance of the work. Proceed with installation only after defects have been corrected.

3.2 INSTALLATION

Installation must meet specified requirements and be in accordance with the manufacturer's installation instructions and approved shop drawings. Do not install damaged materials. Dissimilar materials which are not compatible when contacting each other must be insulated by means of gaskets or sealing/insulating compounds. Keep all exposed surfaces and edges clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Remove stained, discolored, or damaged materials from the site.

3.2.1 Preparation

Clean all substrate substances which may be harmful to insulation, and roof panels including removing projections capable of interfering with insulation, and roof panel attachment.

Install sub-purlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

3.2.2 Underlayment

Install underlayment according to roof panel manufacturer's written recommendations and recommendation in NRCA "The NRCA Roofing and Waterproofing Manual".

3.2.2.1 Self-Adhering Sheet Underlayment

Install self-adhering sheet underlayment; wrinkle free on roof deck. Comply with low-temperature installation restrictions of manufacturer where applicable. Install full coverage over roof deck, lapped in a shingle fashion to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days. Repair any damage or unadhered edges prior to finished roof installation.

3.3 INSULATION INSTALLATION

Install insulation concurrently with metal roof panel installation, in thickness indicated on drawings, to cover entire roof, according to manufacturer's written instructions.

3.4 PROTECTION OF APPLIED MATERIALS

Do not permit storing, walking, wheeling, and trucking directly on applied roofing/insulation materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing/insulation materials, and to distribute weight to conform to indicated live load limits of roof construction.

3.5 FASTENER INSTALLATION

Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions.

3.5.1 Welding

Procedures for manual, shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work must be in accordance with AWS D1.1/D1.1M.

3.6 FLASHING, TRIM, AND CLOSURE INSTALLATION

3.6.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently water tight and weather resistant. Work is to be accomplished to form weather tight construction without waves, warps, buckles, fastening stresses or distortion, and to allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accomplish the work must conform to the manufacturers written instructions.

3.6.2 Metal Flashing

Install exposed metal flashing at building corners, rakes, eaves, junctions between metal siding and roofing, valleys and changes off slope or direction in metal roofing, building expansion joints and gutters.

Exposed metal flashing must be the same material, color, and finish as the specified metal roofing panels. Furnish flashing in minimum 8 foot lengths. Exposed flashing must have 1 inch locked and blind soldered end joints, with expansion joints at intervals of no greater than 16 feet.

Fasten flashing at not more than 8 inches on center for roofs, except where flashing is held in place by the same screws used to secure panels. Exposed flashing and flashing subject to rain penetration must be bedded in specified joint sealant. Flashing which is contact with dissimilar metals must be isolated by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge. Provide sheet metal closures at flashing terminations.

3.7 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels or other components of the Work securely in place, with provisions for thermal and structural movement in accordance with NRCA ASMMRM.

Steel Roof Panels: Use stainless steel fasteners for exterior surfaces and galvanized fasteners for unexposed surfaces.

Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions. Provide all blocking and nailers as required.

Metal Protection: Where dissimilar metals contact each other or possibly corrosive substrates, protect against galvanic action by permanent separation as recommended by the metal roof panel manufacturer.

Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and required for weatherproof performance of metal roof panel system. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

3.7.1 Handling and Erection

Erect roofing system in accordance with the approved erection drawings, printed instructions and safety precautions of the manufacturer.

Do not subject panels to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective panels. Damaged panels must be replaced and removed from the site at the contractor's expense. Erect panels true, plumb, and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with indicated rake, eave, and curb overhang. Allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Do not permit storage, walking, wheeling or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of the roof construction.

Roof panels must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than 8 inches; side laps of standard exterior corrugated panels must not be less than 2-1/2 corrugations.

Field cutting of metal roof panels by torch is not permitted. Field cut only as recommended by manufacturer's written instructions.

3.7.2 Closure Strips

Install metal double closure strips at open ends of metal ridge rolls; open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof, unless open ends are concealed with formed eave flashing; rake of metal roof unless open end has a formed flashing member; and in other required areas.

Install closure strips at intersection of the wall with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.7.3 Workmanship

Make lines, arises, and angles sharp and true. Free exposed surfaces from any visible wave, warp, buckle and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and as necessary to make the work watertight.

3.8 ACCEPTANCE PROVISIONS

3.8.1 Erection Tolerances

Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Horizontal lines must not vary more than 1/8 inch in 40 feet.

3.8.2 Leakage Tests

Finished application of metal roofing is to be subject to inspection and test for leakage by the Contracting Officer or his designated representative, and Architect/Engineer. Inspection and tests will be conducted without cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and removal/replacement of defective materials.

3.8.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials and as recommended by the metal roof panel manufacturer. Finished repaired surfaces must be uniform and free from variations of color and surface texture. Repaired metal surfaces that are not acceptable to the project requirements are to be immediately removed and replaced with new material.

3.8.4 Paint Finished Metal Roofing

Paint finished metal roofing will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period. Panels that indicate color changes, fading, or surface degradation, determined by visual examination, must be removed and replaced with new panels at no expense to the Government. New panels will be subject to the specified tests for an additional year from the date of their installation.

3.9 CLEAN UP AND DISPOSAL

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating. Touch up scratches in panel finish with manufacturer supplied touch-up paint system to match panel finish.

Collect all scrap/waste materials and place in containers. Promptly dispose of demolished and scrap materials. Do not allow scrap/waste materials to

accumulate on-site; transport immediately from the government property and legally dispose of them.

3.10 FIELD QUALITY CONTROL

3.10.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three times during the installation for purposes of reviewing materials installation practices and adequacy of work in place. Make inspections during the first 20 squares of roof panel installation, at mid-point of the installation, and at substantial completion, at a minimum. After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

Submit two signed copies of the manufacturer's field inspection reports to the Contracting Officer within one week of substantial completion.

3.11 INFORMATION CARD

For each type of roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm (0.032) inch thick aluminum card for exterior display. Format as directed in paragraph titled "Form One".

Make card 8 1/2 by 11 inches minimum. Information card must identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, roof panel manufacturer and product name, type underlayment(s), date of completion; installing contractor identification and contact information; manufacturer warranty expiration, warranty reference number, and contact information. Install card at location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

3.11.1 Form One

FORM 1 - PREFORMED STEEL PANEL ROOFING SYSTEM AND COMPONENTS

1. Contract Number:

2. Building Number & Location:

3. NAVFAC Specification Number:

4. Deck/Substrate Type:

5. Slopes of Deck/Roof Structure:

6. Insulation Type & Thickness:

7. Insulation Manufacturer:

8. Vapor Retarder: ( )Yes ( )No

9. Vapor Retarder Type:

10. Preformed Steel Standing Seam Roofing Description:

a. Manufacturer (Name, Address, & Phone No.):
b. Product Name: c. Width: d. Gage:
e. Base Metal: f. Method of Attachment:

11. Repair of Color Coating:

a. Coating Manufacturer (Name, Address & Phone No.):
b. Product Name:
c. Surface Preparation:
d. Recoating Formula:
e. Application Method:

12. Statement of Compliance or Exception:_____
_____
_____

13. Date Roof Completed:

14. Warranty Period: From_____ To_____

15. Roofing Contractor (Name & Address):

16. Prime Contractor (Name & Address):

Contractor's Signature_____ Date:

Roofing Manufacturer Inspector's Signature _____ Date:
Text

-- End of Section --

SECTION 07 42 13

METAL WALL PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501.1	(2005) Methods of Test for Exterior Walls

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002) Cold-Formed Steel Design Manual Set
AISI/COS/NASPEC	(2001, Supplement 2004) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7-05	(2006) Minimum Design Loads for Buildings and Other Structures, Including Supplement No. 1

ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M	(2007a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel
ASTM A 606	(2004) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 653/A 653M	(2007) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 755/A 755M	(2003) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1308	(2002; R 2007) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1667	(2005) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 2244	(2007) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(2002) Measuring Adhesion by Tape Test
ASTM D 3363	(2005) Film Hardness by Pencil Test
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	(2005) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Standard Test Method for Specular Gloss
ASTM D 5894	(2005) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

ASTM D 610	(2007) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(2002e1) Evaluating Degree of Blistering of Paints
ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 968	(2005e1) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM	(2002) Metal Building Systems Manual

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2006) Architectural Sheet Metal Manual, Sixth Edition, Second Printing

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 12	(1982; E 2000) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-28578	(Rev B; CANC Notice 1) Paint, Water-Borne, Acrylic or Modified Acrylic, Semi-Gloss, for Metal Surfaces

UNDERWRITERS LABORATORIES (UL)

UL 580	(2006) Tests for Uplift Resistance of Roof Assemblies
UL Bld Mat Dir	(2007) Building Materials Directory

1.2 DEFINITIONS

Metal Wall Panel: Metal wall panels, attachment system components and accessories necessary for a complete weather-tight wall system.

1.3 DESCRIPTION OF WALL PANEL SYSTEM

Factory color finished, metal wall panel system with concealed fastening attachment. Panel profiles must be as shown on drawings.

1.3.1 Metal Wall Panel General Performance

Comply with performance requirements, conforming to AISI/COS/NASPEC, without failure due to defective manufacture, fabrication, installation, or other defects in construction. Wall panels and accessory components must conform to the following standards:

ASTM A 1008/A 1008M
ASTM A 123/A 123M
ASTM A 36/A 36M
ASTM A 653/A 653M
ASTM A 606
ASTM D 522 for applied coatings
UL Bld Mat Dir

1.3.2 Structural Performance

Maximum calculated fiber stress must not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads is limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal siding. Contractor must provide design for members and connections not shown on the drawings. Siding panels and accessories must be the products of the same manufacturer.

Provide metal wall panel assemblies complying with the load and stress requirements in accordance with ASTM E 1592. Wind Load force due to wind action governs the design for panels.

Wall systems and attachments are to resist the wind loads as determined by UL 580 and ASCE/SEI 7-05 in the geographic area where the construction will take place, in pounds per square foot. Submit five copies of wind load tests and seismic tests to the Contracting Officer.

1.3.3 Air Infiltration

Air leakage must conform to the limits through the wall assembly area when tested according to ASTM E 283.

1.3.4 Water Penetration Under Static Pressure

No water penetration when tested according to ASTM E 331.

1.3.5 Water Penetration Under Dynamic Pressure

No evidence of water leakage when tested according to AAMA 501.1.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submit Documentation for the following items:

Qualification of Manufacturer;
Qualification of Installer;
Sample Warranty;

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Submit Manufacturer's catalog data for the following items:

Factory Color Finish
Closure Materials
Pressure Sensitive Tape
Sealants and Caulking
Accessories

SD-04 Samples

Submit as required each of the following samples:

Wall Panels, 12 inches long by actual panel width;
Fasteners;
Metal Closure Strips, 10 inches long of each type;

Submit manufacturer's color charts and chips, approximately 4 by 4 inches, showing full range of colors, textures and patterns available for wall panels with factory applied finishes.

SD-05 Design Data

As applicable, submit the following wind load design analysis; data, to include, but not limited to:

wind speed
exposure category,co-efficient,importance factor
type of facility
negative pressures for each zone
methods and requirements of attachment

SD-06 Test Reports

Submit test reports for the following in accordance with the referenced articles in this section.

Leakage Tests;
Wind Load Tests;
Coatings and Base Metal Tests;
Chalking Tests;

SD-07 Certificates

Submit certificates for the following items showing conformance with referenced standards contained in this section:

Fasteners;

SD-08 Manufacturer's Instructions

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications.

Installation of Wall panels;

SD-09 Manufacturer's Field Reports

Submit 2 copies of the Manufacturer's Field Reports;

SD-11 Closeout Submittals

Warranty;
Maintenance Instructions;

1.5 QUALITY ASSURANCE

1.5.1 Pre-Installation Conference

Upon notification of submittal receipt and approval by the Contracting Officer; and prior to the commencement of the work, the Contractor must attend a pre-installation conference to review the following:

a. Drawings and Specifications.

b. Qualification of Installer.

d. Sample Warranty

e. Sample wall panels, 12 inches long by actual panel width

f. Sample metal closure strips, 10 inches long of each type

g. Color charts and chips

h. Coatings and base metal tests, chalking tests

i. Construction schedule, availability of materials, Installer's personnel, equipment and facilities required to progress with the work without delay.

j. Methods and procedures related to installation of wall panels, including manufacturer's written instructions. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

k. Support conditions for compliance with requirements, including alignment between and attachment to structural members.

l. Flashing, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.

m. Governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

n. Temporary protection requirements for metal wall panel assembly during and after installation.

o. Wall panel observation and repair procedures after metal wall panel installation. Provide detailed written instructions including copies of Material Safety Data Sheets for maintenance and repair materials, and manufacturer's maintenance instructions.

1.5.1.1 Installation Drawings

Installation shop drawings for wall panels, flashing, accessories, and anchorage systems must indicate completely dimensioned structural frame and erection layouts, openings in the wall, special framing details, and construction details at corners, building intersections and flashing, location and type of mastic and metal filler strips.

1.5.1.2 Wind Load Design Analysis

Wind design analysis must include wall plan delineating dimensions and attachment patterns for each zone. Wind design analysis must be prepared and sealed by Licensed Project Engineer in the geographic area where the construction will take place.

1.5.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and installations in the geographical area where construction will take place.

1.5.3 Qualification of Manufacturer

Certify that metal wall panel system manufacturer has a minimum of five (5) years experience in manufacturing metal wall system and accessory products.

Manufacturer must also provide engineering services by an authorized engineer; currently licensed in the geographical area where construction will take place, having a minimum of four (4) years experience as an engineer knowledgeable in wind load design analysis, protocols and

procedures per MBMA MBSM, "Metal Building Systems Manual"; ASCE/SEI 7-05, and ASTM E 1592.

Provide certified engineering calculations, using the products submitted, for Wind load requirements in accordance with ASCE/SEI 7-05.

1.5.3.1 Manufacturer's Certificates

Also provide the following certifications from the manufacturer:

Coil Stock
Fasteners

Submit certification from coil stock manufacturer or supplier that the machinery used will form the provided coil stock without warping, waviness, or rippling that is not a part of the panel profile, and without damage, abrasion or marring of the finish coating.

Provide evidence that products used within this specification are manufactured in the United States.

1.5.4 Certified Qualification of Installation Contractor

The installation contractor must be approved and certified by the metal wall panel manufacturer prior to beginning the installation of the metal wall panel system. Subcontracting by Certified Contractor for the metal wall panel work is not permitted.

1.5.5 Single Source

Obtain each type of metal wall panels, clips, closure materials and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

1.6 DELIVERY, HANDLING, AND STORAGE

Deliver and protect package components, sheets, metal wall panels, and other manufactured items to prevent damage or deformation during transportation and handling.

Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack and store metal wall panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

Retain strippable protective covering on metal wall panel until actual installation.

1.7 PROJECT CONDITIONS

1.7.1 Field Measurements

Verify locations of wall framing and opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1.7.2 Weather Limitations

Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into wall system or building.

1.8 WARRANTY

Warranty must conform to the Sample Warranty as reviewed and approved by the Contracting Officer at the Pre-Installation Conference.

PART 2 PRODUCTS

2.1 METAL PANELS

2.1.1 Concealed Fastener Panels

Panels for walls, soffits and fascias shall be steel and shall have a factory-applied color finish. Wall panels shall have interlocking ribs for securing adjacent sheets. Panels shall be fastened to framework using concealed fasteners. Length of panels shall be sufficient to cover the entire height of any unbroken wall surface except where reveals are indicated. Panels shall be formed without warping, waviness, or ripples that are not a part of the panel profile and shall be free of damage to the finish coating system.

All exterior flashing and trim shall be fabricated in the same material, gage, finish and color as the exterior profile.

Zinc-coated steel conforming to ASTM A 653/A 653M, Structural Grade 40 and minimum G90 galvanized smooth metallic coating. Prepainted steel sheet shall also comply with ASTM A 755/A 755M. Wall and soffit panel material shall be minimum 22 ga. thick prior to coating application, and as required to meet wind load requirements. Panels shall be within 95 percent of the nominal thickness. Wall and soffit panels shall be smooth, 1 1/2" in depth and provide 12" of coverage width with tight joints between panels. Exterior surface shall have a 12 inch flush plane with a single stiffening bead located in the center of the 12 inch width. Prior to shipment, panels shall be treated with a passivating chemical and oiled to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.1.2 Exposed Fastener Panels

Panels for walls shall be steel and shall have a factory-applied color finish. Provide panel profiles indicated. Panels shall be fastened to framework using exposed fasteners. Length of panels shall be sufficient to cover the entire height of any unbroken wall surface except where reveals are indicated. Panels shall be formed without warping, waviness, or ripples that are not a part of the panel profile and shall be free of damage to the finish coating system.

All exterior trim shall be fabricated in the same material, gage, finish and color as the exterior profile.

Zinc-coated steel conforming to ASTM A 653/A 653M, Structural Grade 37 and minimum G90 galvanized smooth metallic coating. Prepainted steel sheet shall also comply with ASTM A 755/A 755M. Wall panel material shall be minimum 22 ga. thick prior to coating application, and as required to meet wind load requirements. Panels shall be within 95 percent of the nominal thickness. Wall panels shall be smooth and provided in two profiles:

a. Deep Ribbed Metal Panels shall have 36 inch of coverage width and 1 1/2 inch deep symmetrical ribs spaced at 7.2 inches with angular transitions, and with factory mitered edges where corners will be formed by adjacent panels.

b. Corrugated Metal Panels shall have 36 inch minimum coverage width and 1/2 inch deep symmetrical corrugations spaced at 2.67 inches.

Prior to shipment, panels shall be treated with a passivating chemical and oiled to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

2.1.3 Factory Insulated Wall Panels

Insulated wall panels shall be factory-fabricated flat panel units with integral reveals and insulating core between metal face sheets, securely fastened together and uniformly separated with rigid spacers; facing of embossed 22 gage steel, and liner panel of embossed 22 gage steel with primer and acrylic finish. Provide horizontal panels with joint configuration indicated. Panels shall be 2 inches thick and R14 or greater. Panels shall have a factory-applied color finish. The assembly shall have a flame spread rating not higher than 75, and smoke developed rating not higher than 450 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and not become a source of food and shelter for insects. Provide factory formed corners with lengths as indicated. Provide extrusions fabricated of 6063-T5 aluminum with exposed surfaces painted to match wall panels.

2.2 FABRICATION

Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. Fabricate metal wall panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

2.2.1 Sheet Metal Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 that apply to the design, dimensions, metal, and other characteristics of item indicated:

a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

b. End Seams: fabricate nonmoving end seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

c. Sealed Joints: form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA 1793.

d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA 1793 or by metal wall panel manufacturer for application, but not less than thickness of metal being secured.

2.3 PANEL MATERIALS

2.3.1 Steel Sheet

Roll-form steel wall panels to the specified profile, with gauge and depth as indicated. Material must be plumb and true, and within the tolerances listed:

a. Galvanized Steel Sheet conforming to ASTM A 653/A 653M and AISI SG03-3.

b. Individual panels must be continuous length to cover the entire length of any unbroken wall area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.

c. Provide panels with thermal expansion and contraction consistent with the type of system specified.

i. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated wall area.

ii. Embossed Surface Texture.

2.3.2 Factory Color Finish

Comply with NAAMM AMP 500 for recommendations for applying and designating finishes. Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

All panels are to receive a factory-applied Kynar 500/Hylar 5000 finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

2.3.2.1 Metal Preparation

Carefully prepare all metal surface for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.

2.3.2.2 Prime Coating

Apply a base coat of epoxy paint, specifically formulated to interact with the top-coat, to the prepared surfaces by roll coating to a dry film thickness of 0.20 mils. Prime coat must be oven cured prior to application of finish coat.

2.3.2.3 Exterior Finish Coating

Roll coat the finish coating over the primer by roll coating to dry film thickness of 0.80 for a total dry film thickness of 1.00. Oven-cure finish coat.

2.3.2.4 Interior Finish Coating

Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.20 + a backer coat of 0.30 for a total dry film thickness of 0.50. Oven-cured the wash coat.

2.3.2.5 Color

Provide exterior finish color as as specified.

2.3.2.6 Physical Properties

Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General: SSPC Paint 12, MIL-P-28578, ASTM D 5894, and ASTM D 4587.
Abrasion: ASTM D 968
Adhesion: ASTM D 3359
Chalking: ASTM D 4214
Chemical Pollution: ASTM D 1308
Color Change and Conformity: ASTM D 2244
Creepage: ASTM D 1654
Cyclic Corrosion Test: ASTM D 5894
Flame Spread: ASTM E 84
Flexibility: ASTM D 522
Formability: ASTM D 522
Gloss at 60 and 85 degrees: ASTM D 523
Humidity: ASTM D 2247 and ASTM D 714
Oxidation: ASTM D 610
Pencil Hardness: ASTM D 3363
Reverse Impact: ASTM D 2794
Salt Spray: ASTM B 117
Weatherometer: ASTM G 23 and ASTM D 822

2.4 MISCELLANEOUS METAL FRAMING

Cold-formed metallic-coated steel sheet conforming to ASTM A 653/A 653M and specified in Section 05 40 00 COLD-FORMED METAL FRAMING unless other wise indicated.

2.4.1 Fasteners for Miscellaneous Metal Framing

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to supporting members and substrates in accordance with the wall panel manufacturer's and ASCE/SEI 7-05 requirements.

2.5 FASTENERS

2.5.1 General

2.5.1.1 Hidden Fasteners

Provide corrosion resistant fasteners recommended by the manufacturer to meet the performance requirements and design loads.

2.5.1.2 Screws

Screws to be corrosion resistant coated steel, and/or 300 - series or 305 - series stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

2.5.1.3 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

2.5.1.4 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A 653/A 653M, Z275 G 90 or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

2.6 ACCESSORIES

2.6.1 General

All accessories must be compatible with the metal wall panels. Sheet metal flashing, trim, metal closure strips, caps and similar metal accessories must not be less than the minimum thickness specified for the wall panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips must be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

2.6.2 Rubber Closure Strips

Provide closed-cell, expanded cellular rubber conforming to ASTM D 1056 and ASTM D 1667; extruded or molded to the configuration of the specified wall panel and in lengths supplied by the wall panel manufacturer.

2.6.3 Metal Closure Strips

Provide factory fabricated steel closure strips to be the same gauge, color, finish and profile of the specified wall panel.

2.6.4 Joint Sealants

2.6.4.1 Sealants and Caulking

Provide approved gun type sealants for use in hand- or air-pressure calking guns at temperatures above 40 degrees F 4 degrees C (or frost-free application at temperatures above 10 degrees F minus 12 degrees C) with minimum solid content of 85 percent of the total volume. Sealants must dry with a tough, durable surface skin which permit remaining soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints receiving sealants with a compatible one-component or two-component primer as recommended by the wall panel manufacturer.

2.6.4.2 Shop-Applied

Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to ASTM C 920, Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

2.6.4.3 Field-Applied

Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to ASTM C 920, Type II. Color to match panel colors.

2.6.4.4 Pressure Sensitive Tape

Provide pressure sensitive tape sealant, 100% solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the wall panel manufacturer.

2.7 SHEET METAL FLASHING AND TRIM

2.7.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in SMACNA 1793 that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

2.8 REPAIR OF FINISH PROTECTION

Repair paint for color finish enameled wall panel must be compatible paint of the same formula and color as the specified finish furnished by the wall

panel manufacturer. Provide 2 quarts of repair paint matching the specified wall panels.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.

Examine primary and secondary wall framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer, UL, ASTM, ASCE/SEI 7-05 and as required for the geographical area where construction will take place.

Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

Submit to the Contracting Officer a written report, endorsed by Installer, listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment. Miscellaneous framing installation, including sub-purlins, girts, angles, furring, and other miscellaneous wall panel support members and anchorage must be according to metal wall panel manufacturer's written instructions.

3.3 WALL PANEL INSTALLATION

Provide full length metal wall panels, from sill to eave as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement in accordance with MBMA MBSM.

Erect wall panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Bent, chipped, or defective sheets shall not be applied.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated eave, and sill.

Work is to allow for thermal movement of the wall panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal wall panels by torch is not permitted.

3.3.1 Steel Wall Panels

Use stainless-steel fasteners for exterior surfaces and galvanized steel fasteners for interior surfaces.

3.3.2 Anchor Clips

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.3.3 Metal Protection

Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.3.4 Joint Sealers

Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

3.4 FASTENER INSTALLATION

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.5 FLASHING, TRIM AND CLOSURE INSTALLATION

3.5.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams to form permanently watertight and weather resistant.

Install sheet metal work is to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

3.5.2 Metal Flashing

Install exposed metal flashing at building corners, sills and eaves, junctions between metal siding and walling. Exposed metal flashing must be the same material, color, and finish as the specified metal wall panel.

Fasten flashing at a minimum of 8 inches on center, except where flashing is held in place by the same screws that secure covering sheets.

Flashing is to be furnished in at least 8 foot lengths. Exposed flashing is to have 1 inch locked and blind-soldered end joints, and expansion joints at intervals of not more than 16 feet.

Exposed flashing and flashing subject to rain penetration to be bedded in the specified joint sealant.

Isolate flashing which is in contact with dissimilar metals by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge.

3.5.3 Closures

Install metal closure strips at open ends of corrugated or ribbed pattern walls, and at intersection of wall and wall unless open ends are concealed with formed eave flashing; and in other required areas.

Install mastic closure strips at intersection of the wall with metal walling; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.6 WORKMANSHIP

Make lines, arises, and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side.Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

3.7 ACCEPTANCE PROVISIONS

3.7.1 Erection Tolerances

Erect metal wall panels straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions.

3.7.2 Leakage Tests

Finished application of metal wall panels are to be subject to inspection and test for leakage by request of the Contracting Officer, Architect/Engineer. Conduct inspection and tests at no cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and the removal and replacement of defective materials.

3.7.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials. Finished repaired surfaces must be uniform and free from variations of color and surface texture.

Repaired metal surfaces that are not acceptable to the project requirements and/or Contracting Officer are to be immediately removed and replaced with new material.

3.7.4 Paint-Finish Metal Siding

Paint-finish metal siding will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period.

Panels that indicate color changes, fading, or surface degradation, determined by visual examination, must be removed and replaced with new panels at no expense to the Government.

New panels will be subject to the specified tests for an additional year from the date of their installation.

3.8 FIELD QUALITY CONTROL

3.8.1 Construction Monitoring

Make visual inspections as necessary to ensure compliance with specified requirements. Additionally, verify the following:

a. Materials comply with the specified requirements.

b. All materials are properly stored, handled and protected from damage. Damaged materials are removed from the site.

c. Framing and substrates are in acceptable condition, in compliance with specification, prior to application of wall panels.

d. Panels are installed without buckles, ripples, or waves and in uniform alignment and modulus.

e. Side laps are formed, sealed, fastened or seam locked as required.

f. The proper number, type, and spacing of attachment clips and fasteners are installed.

g. Installer adheres to specified and detailed application parameters.

h. Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Provide five bound copies of Manufacturer's Field Reports to the Contracting Officer two weeks prior to project close-out.

3.9 CLEAN-UP AND DISPOSAL

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area continuously as work progresses. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, rust stains, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

Collect and place scrap/waste materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site; transport demolished materials from government property and legally dispose of them.

-- End of Section --

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2170	(2001a) Kinematic Viscosity of Asphalts (Bitumens)
ASTM D 228	1990a (Reapproved 1996) Standard Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles
ASTM D 312	(2000) Asphalt Used in Roofing
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4402	(2002) Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free
ASTM D 5147	(1997) Standard Test Method for Sampling and Testing Modified Bituminous Sheet Material
ASTM D 5849	(1995) Standard Test Method for Evaluating Resistance of Modified, Bituminous Roofing Membranes to Cyclic Joint Displacement
ASTM D 6162	(2000a) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D 6163	(2000e1) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

ASTM D 6164	(2000) Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM E 108	(2000) Fire Tests of Roof Coverings

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2003) Approval Guide

UNDERWRITERS LABORATORIES (UL)

UL 790	(2004) Test Methods for Fire Tests of Roof Coverings
UL RMSD	(2004) Roofing Materials and Systems Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00, "Submittal Procedures."

SD-03 Product Data

Modified Bitumen Sheet;

Felts;

Primer;

Asphalt roof cement;

Fasteners;

Roof and Deck Insulation; G

Sample warranty certificate

Asphalt;

SD-07 Certificates

Qualification of manufacturer;

Qualification of applicator;

Warranty Application;

SD-08 Manufacturer's Instructions

Modified bitumen sheet;

Felts;

Primer;

Asphalt roof cement;

Fasteners;

Flashings;

Asphalt;

Cold weather installation

SD-11 Closeout Submittals

Information card;

1.3 QUALITY ASSURANCE

1.3.1 Product Data Requirements

Submit data for the roof insulation and modified Bitumen sheet as required below:

1.3.1.1 Roof Insulation Product Data Requirements

Submit all data required by Section 07220, "Roof and Deck Insulation," together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation provided.

1.3.1.2 Modified Bitumen Sheet Product Data Requirements

Manufactures published catalog data shall include the following information for each sheet type specified. This information shall be presented in the same units of measure stated in this specification and its referenced standards. The test method for determining the following sheet requirements are found in ASTM D 5147, ASTM D 228 for Net Mass (Weight) requirements, and in ASTM D 5849 for cyclic joint displacement.

a. Dimensions and Weight

(1) Thickness
(2) Net Mass (Weight)

b. Physical and Mechanical Properties

(1) Sheet type
(2) Load strain properties
(3) Ultimate elongation (fiberglass reinforcing only)
(4) Tear strength
(5) Low temperature flexibility
(6) Dimensional stability
(7) Compound stability
(8) Granule embedment

c. Performance

(1) Cyclic joint displacement

1.3.2 Manufacturer's Instruction Requirements

Include detailed application instructions and standard drawings altered as required by these specifications for modified bitumen sheet, primer, fasteners, asphalt roof cement, flashings, asphalt, and cold weather installation. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

1.3.3 CERTIFICATE REQUIREMENTS

1.3.3.1 Manufacturers Qualifications Certificates

Certify that the manufacturer of the modified bitumen membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer." Show evidence that products used within this specification are manufactured in the United States. Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

1.3.3.2 Warranty Application Certificate

Provide copy of Application for Roofing Guarantee from roofing contractor and Letter of Intent to Warrant for the roofing system by the Manufacturer.

1.3.4 Closeout Submittal Requirements

Furnish requirements as specified in paragraph entitled "Information Card" in PART 3 of this section.

1.3.5 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer shall have a minimum of 5 years experience in manufacturing modified bitumen roofing products specified herein.

1.3.6 Qualification of Applicator

Roofing system applicator shall be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and shall have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator shall supply the names and locations of 5 projects of similar size and scope that he has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.3.7 Fire Safety

Complete roof covering assembly shall:

a. Have ASTM E 108 Class 1A or UL 790, Class A classification; and

b. Be listed as part of Fire-Classified roof deck construction in UL RMSD, or Class I roof deck construction in FM P7825.

UL approved components of the roof covering assembly shall bear the UL label.

1.3.8 Wind Uplift

Complete roof covering assembly including the roof insulation shall be tested and rated in compliance with FM P7825 and shall be installed to meet an FM 1A-90 classification for the field of the roof with respective increased fastener attachment at the perimeters and corners of the roof.

1.3.9 Preroofing Conference

After approval of submittals and before performing roofing and insulation work, including associated work, the Contractor will hold a preroofing conference to review the following:

a. Drawings and specifications;

b. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, roof insulation, and installation of the roofing in accordance with the roof system warranty, the name of the manufacturer's technical representatives, the frequency of the onsite visits, copies of the roof status reports from the technical representatives to roof manufacturer, and pertinent structural details relating to the roofing system;

c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

d. Safety requirements.

Preroofing conference shall be attended by the designer, the Government, the Contractor and personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, mechanical and electrical work and representative of the roofing materials manufacturer. Before beginning roofing work, confirm in writing the resolution of conflicts among those attending the preroofing conference.

1.3.10 Field Samples and Tests

The Government reserves the right to sample roofing materials at random from the products delivered to the job site and test them to verify the products either conform to the referenced specifications or the approved substitution. Products which do not conform shall be removed from the job site and replaced with new products that conform to the referenced specification or the approved substitution.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Ship modified bitumen sheet rolls stacked vertically on pallets wrapped with shrink wrap or shrink bags. Pallets to be surfaced with a continuous smooth surface to avoid damage to ends of rolls. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container shall bear the specification number, type, and class, as applicable. Labels or bill of lading for roofing asphalt shall indicate asphalt type, FP, FBT, and EVT, that is, the temperature at which the viscosity is either 125 centistokes when tested in accordance with ASTM D 2170 or 75 centipoise when tested in accordance with ASTM D 4402. Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.4.2 Storage

Protect materials against moisture absorption. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, and mortar is finished and dry. Maintain roll materials at temperatures above 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof and yet provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

1.4.3 Handling

Select and operate material handling equipment so as not to damage applied roofing. Prevent damage to edges and ends of roll materials.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Provide manufacturer's printed directions for installation during cold weather conditions.

1.6 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that flashing and counter flashing are installed as the work progresses. No phasing of the roof membrane system installation will be permitted. Same day installation of mechanically fastened bottom insulation board, adhered upper insulation board(s), base ply, base ply cap flashing, top ply and top ply cap flashing is required.

1.7 WARRANTY

Furnish the modified bitumen sheet roofing system manufacturer's "no-dollar-limit" warranty for the roofing system, including insulation, flashing, and

accessories. The warranty shall run directly to the Government. In no event shall the warranty period be less than 10 years from the date of the Government's acceptance of the work, notwithstanding roofing applicator's or manufacturer's unpaid invoices for installation, supplies, or service. The warranty shall state that:

a. When within the warranty period the roofing system becomes nonwatertight, splits, tears, blisters, or separates at the seams or shows any other evidence of excessive weathering, because of defective materials or workmanship, the repair or replacement of defective materials and correction of defective workmanship shall be the responsibility of the manufacturer;

b. When the manufacturer or the manufacturer's approved applicator fail to perform repairs within 72 hours of notification, emergency repairs performed by others will not void the warranty.

PART 2 PRODUCTS

2.1 DESCRIPTION OF ROOFING SYSTEM

2.1.1 Description of Roofing System

Provide roofing system as described below and capable of passing ASTM D 5849. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles at 14° F -10° C or 200 cycles after heat conditioning. Heat conditioning shall be in accordance to ASTM D 5147.

2.1.2 SBS Modified Bitumen Sheet on Non-Nailable Substrate

Substrate: Metal Deck

Components:	Quantity:
Asphalt Primer	3/4 gal/100 sq. ft.
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Base Sheet (MB)	1 ply
Type IV Asphalt	25 lbs/100 sq. ft.
SBS Modified Bitumen Cap Sheet (RSS)	1 ply

2.2 MATERIALS

2.2.1 Asphalt

ASTM D 312, Type IV.

2.2.2 Modified Bitumen Sheet, Felts

Provide all field sheets of the roofing membrane with the same type reinforcing material.

Designation	Use	Felt-Type	Impregnant	Coating	Specification

MB	SBS Modified Base Sheet	Fiber-glass or Poly-ester or combined fiberglass polyester	SBS Modified Bitumen	SBS Modified Bitumen	ASTM D 6162, Grade S, and as modified in subparagraph "a" below ASTM D 6163, Grade S, Type II and as modified in subpara. "b" below ASTM D 6164, Grade S, and as modified in subpara. "c" below
RSS	SBS Bitumen Cap Sheet Roofing Fire rated	Fiber-glass or Poly-ester	SBS Modified Bitumen	SBS Bitumen Granules	ASTM D 6162, Grade G,Type II and as modified in subpara. "a" below ASTM D 6163, Grade G, and as modified in subpara. "b" below ASTM D 6164, Grade G, and as modified in subpara. "c" below
FS	Flashing Sheet Fire rated	Fiber glass or fiberglass or combined	SBS Modified Bitumen	Granule Surfacing	ASTM D 6162, Grade S, and as modified in subparagraph "a" below ASTM D 6163, Grade S, Type II and as modified in subpara. "b" below ASTM D 6164, Grade S, and as modified in subpara. "c" below

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a. ASTM D 6162 Modifications (Combined Polyester and Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements

Property	Type II Grade: G and S
Low Temperature Flexibility, Max Before and After Heat Conditioning °F ° (C)	-5(-20)

(2) "7. Dimensions, Mass, and Permissible Values" Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirement.

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using A Combination of Polyester and Glass Fiber Reinforcements

Description	Type II
Thickness, min, mils (mm)	
Grade S	85 (2.2)
Grade G	150 (3.8)
Grade G (Selvage Edge)	95 (2.4)
Net mass unit area, min lbs/100 ft 2, (g/m2)	
Grade S	58 (2831)
Grade G	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

b. ASTM D 6163 Modifications (Glass Fiber Reinforcing)

(1) "6. Physical Properties." Modify paragraph 6.1 by deleting the ASTM Physical property values from reference Table 2, that are in conflict with this specification note. The physical property values listed below supersede that ASTM requirement.

TABLE 2 Physical Properties of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Property	Type II Grade: G and S
Elongation (ultimate) at 5% of maximum load 73.4 +/- 3.6 degrees F (23 +/- 2 degrees C), MD and XMD, min. (%)	
as manufactured:	40
after heat conditioning:	20
Compound stability at 225 degrees F (107 degrees C)	no failures

(2) "7. Dimensions, Mass and Permissible Variations." Modify paragraph 7.2 by deleting the ASTM dimensions and masses from reference Table 1, that are in conflict with this specification note. The dimension and mass values listed below supersede the ASTM requirement.

TABLE 1 Dimensions and Masses of SBS Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

Description	Type II
Thickness, min, mils (mm),	
Grade S	85 (2.2)
Grade G	150 (3.8)
Grade G (Selvage Edge)	95 (2.4)
Net mass/unit area, min, lbs/ft 2 (g/m 2)	
Grade S	58 (2831)
Grade G	90 (4394)

(3) "8. Workmanship, Finish and Appearance" Modify paragraph 8.2 by adding the following sentence to the end of the paragraph. Granules shall completely obstruct the view of the SBS modified bituminous coating substrate. Three 305x 610 mm 12x24 inch samples shall be taken from three different rolls of roofing materials delivered to the site and observed with the naked eye with daylighting at a distance a 915 mm 3 feet."

2.2.3 Top Surfacing

Protect modified bitumen roofing system from direct exposure to the weather with the following surfacing.

2.2.3.1 Mineral Roofing Granules

Factory applied, Type II minimum granule embeddment, requiring no further coating.

2.2.4 Primer

ASTM D 41.

2.2.5 Asphalt Roof Cement

ASTM D 4586, Type II for vertical surfaces, Type I for horizontal surfaces.

2.2.6 Fasteners

Provide noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM AS 4470. For felts, provide fasteners driven through metal discs, or one piece composite fasteners with heads not less than one inch in diameter or one inch square with rounded or 45 degree tapered corners.

2.2.6.1 Concrete Walls and Vertical Surfaces

Provide hardened steel nails with flat heads, diamond shaped points, and mechanically deformed shanks not less than one inch long for securing felts, modified bitumen sheets, and metal Items to concrete walls and vertical surfaces. Use power-driven fasteners only when approved in writing.

2.2.7 Metal Discs (Tin Caps)

Flat noncorrosive fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM AS 4470; not less than 3 inches in diameter, when using screw type fasteners. Discs shall be formed to prevent dishing or cupping.

2.2.8 Roof Insulation Below Modified Bitumen Membrane System

Insulation shall be compatible with the membrane as recommended in modified bitumen manufacturer's printed instructions and as specified in Section 07 22 00, "Roof and Deck Insulation".

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Ensure that the following conditions exist prior to application of the roofing materials:

a. Drains, curbs, cants, perimeter walls, roof penetrating components, and equipment supports are in place.

b. Surfaces are rigid, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.

c. The plane of the substrate does not vary more than 1/4 inch within an area 10 by 10 feet when checked with a 10 foot straight edge placed anywhere on the substrate.

d. Substrate is sloped as indicated to provide positive drainage.

e. Walls and vertical surfaces are constructed to receive counter flashing, and will permit nailing of the base flashing materials.

f. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of felts, edging strips, gravel stops, and roof fixtures. Surface-applied nailers are the same thickness as the roof insulation.

g. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than nominal 4 inches. Cants are constructed of treated wood or wood fiberboard roof insulation.

h. Venting is provided in accordance with the following:

(1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.

i. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. Insulation is being roofed over on the same day the insulation is installed.

j. Cast-in-place substrates have been allowed to cure and the surface dryness requirements specified under paragraph entitled "Field Quality Control" have been met.

3.2 PREPARATION

3.2.1 Protection of Property

3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings not less than six inches, secure against wind, and vent to prevent collection of

moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

3.2.1.2 Flame-Heated Equipment

Do not place flame-heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame-heated equipment and on the roof.

3.2.1.3 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

3.2.2 Priming of Surfaces

Prime surfaces at the rate of 0.75 gallon per 100 sq. ft. or as recommended by modified bitumen sheet manufacturer's printed instructions and allow to dry.

3.2.2.1 Priming of Metal Surfaces

Prime flanges of metal edging strips, prior to stripping into roofing system in accordance with modified bitumen manufacturer's printed instructions and allow to dry.

3.2.3 Heating of Asphalt

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Kettles shall have visible thermometer and thermostatic controls set to the temperature limits specified herein. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus 2 degrees F, to check temperatures of the asphalt frequently. When temperatures exceed maximums specified, remove asphalt from the site. Do no permit cutting back, adulterating, or fluxing of asphalt.

3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by manufacturer's printed application instructions and approved by the Contracting Officer. Keep roofing materials dry before and during application. Do not permit phased construction.Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. Modified Bitumen Base Sheet shall not remain exposed prior to application of the Modified Bitumen Cap Sheet. A hand-held thermometer in required on the roof at all times during roofing installation to check EVT of asphalt.

3.3.1 Base Sheet

Apply base sheets in shingle fashion in hot mopping of asphalt. On nailable substrates, mechanically fasten base sheet in conformance with FM requirements and membrane manufacturer's printed instructions. Where applicable, base sheet may be mechanically fastened in conjunction with

insulation to the substrate, in accordance with membrane manufacturers printed instructions. Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 2 inches unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 6 inches and staggered a minimum of 36 inches. Apply sheets at right angles to the roof slope so that the direction of water flow is over and not against the laps. Extend sheets approximately 2 inches above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim felt to a neat fit around vent pipes, roof drains, and other projections through the roof.Application shall be free of ridges, wrinkles, and buckles or other voids.

3.3.2 Hot-Mopping of Base Sheets

Provide hot asphalt for embedding of base sheets, including modified bitumen base sheet, to the substrate.Apply base sheets immediately following application of hot asphalt. Do not work ahead with asphalt.Asphalt shall be completely fluid, with mop temperatures within the specified EVT range, at the instant base sheets come into contact with asphalt. Application of bitumen between plies shall be such as to provide full, continuous, uniform coverage and complete penetration of asphalt into the sheet above and below. Embed sheets in asphalt. As sheets are being rolled into hot asphalt, immediately and thoroughly squeegee, roll, or broom down to eliminate trapped air and to provide tight, smooth laminations without wrinkles, buckles, kinks, and fish mouths. Completed system shall be free of air pockets, blisters and other voids.

3.3.2.1 Temperature Limitations for Asphalt

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its FBT. Do not heat asphalt between 500 and 525 degrees F for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed base sheets when temperature of asphalt is within plus or minus 25 degrees F of the equiviscous temperature (EVT). Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP, FBT, and EVT of the asphalt used.

3.3.3 Modified Bitumen Sheets

Sheets shall be watertight and visually free of pinholes, particles of foreign matter, undispersed raw material, or other manufacturing defects that might affect serviceability. Edges of seams shall be straight and flat so that they may be seamed to one another without forming fish mouths, wrinkles or other voids.

3.3.3.1 SBS Modified Bitumen Sheets

Solid mop top surface of base sheet with hot asphalt at the rate of 25 pounds per 100 sq. ft. and embed one layer of roofing membrane into hot asphalt. Roll modified bitumen roofing membrane into place with a flow of hot asphalt out of side and end laps. Side laps shall be 4 inches and end laps shall be 6 inches or as recommended by the manufacturer. Stagger end laps a minimum of 36 inches. Back mop end laps. Apply roofing in a

continuous application. Start installation at the low point of the roof and progress to the high point. Provide tight, smooth laminations without wrinkles, ridges, buckles, kinks, and fishmouths. Completed system shall be free of air pockets, blisters, ridges, fishmouths, and open laps.

3.3.4 Flashings

Two piles of flashing are required. First ply of equal or greater thickness as the base sheet, and second ply of equal or greater thickness as the cap sheet. Apply granular surfaced modified bitumen sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, in accordance with membrane manufacturer's printed application instructions and where necessary to make the work watertight. Metal flashing collars and cap flashings are specified under Section 07 60 00, "Flashing and Sheet Metal." Do not set metal flashing in hot asphalt.

3.3.5 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.3.6 Protection of Applied Roofing Against Moisture Absorption

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system as follows.

3.3.6.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation boards and seal the terminated edge of modified bitumen roofing system with two full width strips of roofing felt set in and coated with asphalt roof cement. One-half width of the strips shall extend up and over the finished roofing and the other half-width extended out onto the bare deck unless recommended otherwise in membrane manufacturer's printed application instructions. Seal off flutes in metal decking along the cutoff edge. Pull membrane free/loose or cut to expose the insulation when resuming work, and remove the insulation boards used for fill-in.

3.3.6.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Temporary flashings shall consist of one ply of ply felt applied in a trowel coat of asphalt roof cement applied to a primed surface, and finished with a surface coat of asphalt roof cement. Remove temporary flashing before applying permanent flashing.

3.3.6.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.4 INFORMATION CARD

For each roof type, furnish a typewritten card, a photoengraved 0.032 inch thick aluminum card for exterior display. Card shall be 8 1/2 by 11 inches minimum and shall contain the information listed on Form 1 located at end of this section. Install card near point of access to roof, or as instructed by the Government.

FORM 1, ROOFING SYSTEM DESCRIPTION

1. Location _____ 2. Bldg. Name _____

3. Bldg. No. _____ 4. Roof Area (SF) _____ 5. Contract No. _____

6. New Construction: ( ) Yes ( ) No 7. Deck Slope: _____

8. Type of Deck:
   ( ) Metal
   ( ) Cast-In-Place Concrete
   ( ) Precast/Prestressed Concrete
   ( ) Wood Plank or Plywood
   ( ) Other _____

9. Type of Insulation Board:
   ( ) Polyisocyanurate/Composite
   ( ) Polystyrene/Composite
   ( ) Perlite
   ( ) Other _____
   ( ) Polyisocyanurate Foam
   ( ) Polystyrene
   ( ) Mineral Fiber

10. Insulation Manufacturer: _____

11. Insulation Thickness: _____

12. Vapor Treatment: Total coverage ( ) Yes ( ) No
    ( ) No Vapor Retarder
    ( ) One Way Roof Vents
    ( ) Other _____
    ( ) Bituminous Vapor Retarder
    ( ) Laminated Kraft Paper

13. Vapor Treatment Manufacturer(s): _____

14. Roofing Type:
    ( ) Built-Up (Asphalt)
    ( ) Built-Up (Coal-Tar)
    ( ) Metal
    ( ) Shingles
    ( ) PIB
    ( ) Modified Bitumen
    ( ) CSPE
    ( ) Other _____
    ( ) TPA
    ( ) EPDM
    ( ) PVC

15. Roofing Manufacturer: _____

16. Roofing Installer/Warrantor: _____

17. Roofing Application Method:
    ( ) Bitumen ( ) Fully Adhered ( ) Loose-Laid
    ( ) Mechanically Fastened ( ) Torched Ballasted
    ( ) Mechanically Fastened/Fully Adhered ( ) Other _____

18. Warranty Period: From _____ To _____

19. Warranty Serial Number: _____

20. Date Roofing Completed: _____ 21. Inspector: _____

22. Prime Contractor Name/Address: _____

Signature: _____ Date: _____

INSTRUCTIONS FOR FORM 1 (Do Not Post)

1. Location: Name of activity as shown on contract.

2. Bldg. Name: As shown on contract or as provided by Contracting Officer.

3. Bldg. Number: As provided by Contracting Officer.

4. Roof Area: Area in square feet of roof for which deck insulation, membrane, etc. are the same. A separate form is required if any part of roof system is different over other areas of the roof.

5. Contract Number: As shown on the contract.

7. Show deck slope.

8. Deck: Check appropriate block.

9. Type of Insulation Board: Check appropriate block.

11. Show minimum thickness of installed insulation.

12. Vapor Treatment: Check appropriate blocks.

13. Show vapor treatment system manufacturer's name.

14. Roofing Type: Check appropriate block.

15. Show roofing manufacturer's name.

16. Roofing Installer's or Contractor's name.

17. Roofing Application Method: Check appropriate block.

18. Warranty Period: Insert start and end dates.

20. Show date roofing was accepted by the Contracting Officer. Warranty period begins on this date.

21. Show Government Inspector's name.

22. Prime Contractor Name/Address/Signature: Must be signed and dated by QC Manager.

-- End of Section --

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M	(2008) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B101	(2007) Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B69	(2011) Standard Specification for Rolled Zinc
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 4586	(2007) Asphalt Roof Cement, Asbestos-Free
ASTM D41/D41M	(2011) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793 (2003) Architectural Sheet Metal Manual, 6th Edition

1.2 GENERAL REQUIREMENTS

Finished sheet metalwork will form a weathertight construction without waves, warps, buckles, fastening stresses or distortion, which allows for expansion and contraction. Sheet metal mechanic is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous roofing operations.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gutters;

Downspouts;

Expansion joints;

Gravel stops and fascias;

Splash pans;

Base flashing;

Counterflashing;

Flashing at roof penetrations;

Drip edge;

Eave flashing;

Indicate thicknesses, dimensions, fastenings and anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.4 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition as determined and instructed by the COR. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA Arch. Manual for a particular item, unless otherwise specified or indicated. Conform to the requirements specified and to the thicknesses and configurations established in SMACNA Arch. Manual for the materials. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items must be copper.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used except as follows:

2.1.1 Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fascias; cap, valley, steeped, base, and eave flashings, and related accessories.

2.1.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.1.3 Copper, Sheet and Strip

ASTM B370, cold-rolled temper, H 00 (standard).

2.1.4 Lead-Coated Copper Sheet

ASTM B101.

2.1.5 Lead Sheet

Minimum weight 4 pounds per square foot.

2.1.6 Steel Sheet, Zinc-Coated (Galvanized)

ASTM A653/A653M.

2.1.6.1 Finish

Exposed exterior items of zinc-coated steel sheet must have a baked-on, factory-applied color coating of polyvinylidene fluoride or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and

pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color to match adjacent material.

2.1.7 Zinc Sheet and Strip

ASTM B69, Type I, a minimum of 0.024 inch thick.

2.1.8 Stainless Steel

ASTM A167, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

2.1.9 Aluminum Alloy Sheet and Plate

ASTM B209 color to match adjacent material form alloy, and temper appropriate for use.

2.1.9.1 Alclad

When fabricated of aluminum, fabricate the items Alclad 3003, Alclad 3004, Alclad 3005, clad on both sides unless otherwise indicated.

a. Gutters, downspouts, and hangers

b. Gravel stops and fascias

c. Flashing

2.1.9.2 Finish

Exposed exterior sheet metal items of aluminum must have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color of to match adjacent material.

2.1.10 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B221.

2.1.11 Solder

ASTM B32, 95-5 tin-antimony.

2.1.12 Bituminous Plastic Cement

ASTM D 4586, Type I.

2.1.13 Roofing Felt

ASTM D 226/D 226M Type I.

2.1.14 Asphalt Primer

ASTM D41/D41M.

2.1.15 Fasteners

Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.2 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inch. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work.

3.1.3 Cleats

Provide cleats for sheet metal 18 inch and over in width. Space cleats evenly not over 12 inch on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of 2 inch wide by 3 inch long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. Pretin cleats for soldered seams.

3.1.4 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inch or less in thickness.

3.1.5 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.5.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

3.1.5.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

3.1.5.3 Loose-Lock Expansion Seams

Not less than 3 inch wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 1/8 inch thick bed.

3.1.5.4 Flat Seams

Make seams in the direction of the flow.

3.1.6 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pretin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.6.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pretinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.7 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.7.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

3.1.7.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inch maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inch from the end of the overlapping sheet.

3.1.8 Protection from Contact with Dissimilar Materials

3.1.8.1 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.8.2 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.8.3 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.9 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascias by expansion and contraction joints spaced not more than 12 feet apart.

3.1.10 Base Flashing

Extend up vertical surfaces of the flashing not less than 8 inch and not less than 4 inch under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 6 inch. Overlap the flashing strips with the previously laid flashing not less than 3 inch. Fasten the strips at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 6 inch on center with hex headed, galvanized shielded screws a minimum of 2-inch lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of curbs and similar vertical surfaces, extending through sloping roofs, the metal flashings. Extend the metal flashings onto the roof covering not less than 4.5 inch at the lower side of vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Provide factory-fabricated base flashing for interior and exterior corners.Do not use metal base flashing on built-up roofing.

3.1.11 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inch above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inch. Fold the exposed edges of counterflashings 1/2 inch. Where stepped counterflashings are required, they may be installed in short lengths a minimum 8 inch by 10 inch or may be of the preformed one-piece type. Provide end laps in counterflashings not less than 3 inch and make it

weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 10 feet. Form the flashings to the required shapes before installation. Factory-form the corners not less than 12 inch from the angle. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inch into the walls. Install counterflashing to provide a spring action against base flashing.

3.1.12 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1 1/4 inch, as approved.

3.1.12.1 Caulked Reglets

Provide with rounded edges and metal strap brackets or other anchors for securing to the concrete forms. Provide reglets with a core to protect them from injury during the installation. Provide built-up mitered corner pieces for internal and external angles.Wedge the flashing in the reglets with lead wedges every 18 inch, caulked full and solid with an approved compound.

3.1.12.2 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snaplock receiver. Insert the flashing the full depth of the slot and lock by indentations made with a dull-pointed tool, wedges, and filled with a sealant. For friction reglets, install flashing snaplock receivers at 24 inch on center maximum. When the flashing has been inserted the full depth, caulk the slot and lock and fill with sealant.

3.1.13 Metal Drip Edge

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inch and secure with compatible nails spaced not more than 10 inch on center along upper edge.

3.1.14 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation.Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in sections not less than 8 feet.Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inch minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets.Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on by cleats spaced not less than 36 inch apart. Adjust gutters to slope uniformly to outlets,

with high points occurring midway between outlets. Fabricate hangers and fastenings from metals.

3.1.15 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the masonry or steel substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

3.1.15.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

3.1.16 Splash Pans

Install splash pans where downspouts discharge on roof surfaces and at other locations as indicated. Unless otherwise shown, provide pans not less than 24 inches long by 18 inches wide with metal ribs across the bottom of the pan. Form the sides of the pan with vertical baffles not less than one inch high in the front, and 4 inches high in the back doubled over and formed continuous with horizontal roof flanges not less than 4 inches wide. Bend the rear flange of the pan to contour of cant strip and extend up 6 inches under the side wall covering or to height of base flashing under counterflashing. Bed the pans and roof flanges in plastic bituminous cement and strip-flash as specified.

3.1.17 Eave Flashing

One piece in width, applied in 8 to 10 foot lengths with expansion joints spaced as specified in paragraph entitled "Expansion and Contraction." Provide a 3/4 inch continuous fold in the upper edge of the sheet to engage cleats spaced not more than 10 inches on center. Locate the upper edge of flashing not less than 18 inch from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with one inch flat locked joints with cleats that are 10 inches on center.

3.1.18 Expansion Joints

Provide expansion joints for roofs, walls, and floors as indicated. Provide expansion joints in continuous sheet metal at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum, aluminum gravel stops and fascias which must have expansion joints at not more than 12 foot spacing. Provide evenly spaced joints. Provide an additional joint where the distance between the last expansion joint and the end of the continuous

run is more than half the required interval spacing. Conform to the requirements of Table I.

3.1.18.1 Roof Expansion Joints

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Bituminous base flashing is specified in Roofing Section. Provide counterflashing as specified in paragraph "Counterflashing," except as follows: Provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than one inch for flashing on one side of the expansion joint and be less than the width of the expansion joint plus one inch for flashing on the other side of the joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

3.1.19 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck. Goose-necks, rainhoods, and power roof ventilators are specified in 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS.

3.1.20 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inch on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inch. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inch roof flange in bituminous plastic cement and nailed 3 inch on center. Extend sleeve a minimum of 8 inch above the roof deck and lapped a minimum of 3 inch by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

3.2 PAINTING

Field-paint sheet metal for separation of dissimilar materials.

3.2.1 Aluminum Surfaces

Shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification that specified material is provided and installed.

c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

Sheet Metal Items	Aluminum, Inch	Stainless Steel, Inch	Zinc-Coated Steel, U.S. Std. Gage
Building Expansion Joints			
Cover.....	.032	.015	24
Downspouts and leaders	.032	.015	24
Downspout clips and anchors	.040 clip	-	-
	.125 anchor	-	-
Downspout straps, 2-inch	.060	.050	-
Flashings:			
Base	.040	.018	24
Cap (Counter-flashing)	.032	.015	26
Eave	-	.015	24
Pipe vent sleeve(d)			

Gravel stops and fascias:			
Extrusions	.075	-	-
Sheets, smooth	.050	.018	24
Edge strip	.050	.025	-
Gutters:			
Gutter section.....	.032	.015	24
Continuous cleat.....	.032	.015	24
Hangers, dimensions	1 inch by .080 inch (c)	1 inch by .037 inch	-
Joint Cover plates... (See Table II)	.032	.015	24
Reglets (c)	-	.010	-
Splash pans	.040	.018	-

(a) Brass.

(b) May be lead weighing 4 pounds per square foot.

(c) May be polyvinyl chloride.

(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph entitled "Single Pipe Vents" for optional material.

TABLE II. SHEET METAL JOINTS

Item Designation	TYPE OF JOINT		
	Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	1.25 inch single lock, standing seam, cleated	1.25 inch single lock, standing	- - -
Flashings			
Base	One inch 3 inch lap for expansion joint	One inch flat locked, soldered; sealed; 3 inch lap for expansion joint	Aluminum producer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound

			compound.
Cap-in reglet	3 inch lap	3 inch lap	Seal groove with joint sealing compound.
Reglets	Butt joint	- - -	Seal reglet groove with joint sealing compound.
Eave	One inch flat locked, cleated One inch loose locked, expansion joint cleated	One inch flat locked, locked, cleated one inch loose locked, sealed expansion joints, cleated	Same as base flashing.
Edge strip	Butt	Butt	- - -
Gravel stops:			
Extrusions	- - -	Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing backup plate.
Gutters	1.5 inch lap, riveted and soldered	One inch flat locked, riveted, and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.

(a) Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.

(b) Seal polyvinyl chloride reglet with manufacturer's recommended sealant.

-- End of Section --

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 119	(2011) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E 1399	(1997; R 2009) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E 1966	(2007) Fire-Resistive Joint Systems
ASTM E 2174	(2010a) Standard Practice for On-Site Inspection of Installed Fire Stops
ASTM E 2307	(2010) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E 2393	(2010a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
ASTM E 814	(2011a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
FM AS 4991	(2001) Approval of Firestop Contractors

UNDERWRITERS LABORATORIES (UL)

UL 1479	(2003; Reprint Mar 2010) Fire Tests of Through-Penetration Firestops

UL 2079	(2004; Reprint Jun 2008) Tests for Fire Resistance of Building Joint Systems
UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 General

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.

b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2.2 Sequencing

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.2.3 Submittals Requirements

a. Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are

to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

b. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification from UL of passing the "Aging and Environmental Exposure Testing " portion of UL 1479.

c. Submit documentation of training and experience for Installer.

d. Submit manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials;

SD-07 Certificates

Firestopping Materials

Installer Qualifications;

Inspection;

1.4 QUALITY ASSURANCE

1.4.1 Installer

Engage an experienced Installer who is:

a. FM Research approved in accordance with FM AS 4991, operating as a UL Certified Firestop Contractor, or

b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer written certification of training, and retain proof of certification for duration of firestop installation.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements. Remove damaged or deteriorated materials from the site.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic, water-based, noncombustible products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment. Firestop material must be free from Ethylene Glycol, PCB, MEK, or other types of hazardous chemicals.

2.1.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SYSTEM DESCRIPTION, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = Rating of wall or partition being penetrated.

b. Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = 1 hour, T Rating = 1 hour. Where the penetrating item is outside of a wall cavity the F rating and T rating must be equal to the fire resistance rating of the floor penetrated.

c. Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = 1 hour, T Rating = 1 hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SYSTEM DESCRIPTION, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur, as follows: construction joints in walls, 1 hour; construction joints in floors, 1 hour; gaps between floor slabs and curtain walls, 1 hour; gaps between top of the walls and the bottom of roof and floor decks, 1 hour, and provide L rating of <5 cfm/lf where required. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E 2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.1.4 Material Performance

All firestop materials are subject to these minimum standards of performance.

a. Firestop material shall be capable of installation at temperatures of 35 to 120 degrees F.

b. Material must be able to be frozen, thawed and still maintain manufacturer approval for installation.

c. Firestop material must convey a manufacturer's written warranty guaranteeing the performance of the material for the sustainable lifetime of the structure.

d. Material must maintain a shelf life of no less than 2 years form date of manufacturing.

e. Acceptable firestop cast-in-place devices are factory assembled intumescent lined round or oval plastic cylinders capable of protecting plastic, metallic, cable, and blank openings through the cast-in-place device equal to the fire-resistance rating of the floor.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products. Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0% to 100% visual fill of penetrants; while maintaining "L" rating of <5 cfm/sf measured at ambient temperature and 400* F at 0% to 100% visual fill. Each device must be capable of retrofit applications and be available in square and round configurations, with single, double, triple and six-plex bracket systems provided. Firestop devices must also allow for plastic pipe, metallic pipe, and mixed multiple

penetrations plastic, metallic, insulated metallic, and cable through a single device.

3.3 INSPECTION

3.3.1 General Requirements

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the manufacturer's technical representative. The manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.3.2 Inspection Standards

Inspect all firestopping in accordance to ASTM standards for firestop inspection, and document inspection results to be submitted to the Owner.

a. ASTM E 2393

b. ASTM E 2174

-- End of Section --

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C734	(2006) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C919	(2008) Use of Sealants in Acoustical Applications
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 217	(2010) Cone Penetration of Lubricating Grease
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). Provide a copy of the Material Safety Data Sheet for each solvent, primer or sealant material.

SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 90 degrees F or less than 0 degrees F.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility with Substrate

Verify that each of the sealants is compatible for use with joint substrates.

1.5.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6 SPECIAL WARRANTY

Guarantee sealant joint against failure of sealant and against water penetration through each sealed joint for five years.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

2.1.1 Interior Sealant

Provide ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant for the following:

	LOCATION	COLOR
a.	Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.	Match adjacent surface color
b.	Perimeter of frames at doors, windows and access panels which adjoin exposed	Match adjacent surface color

interior concrete and masonry surfaces.

c.	Joints between edge members for acoustical tile and adjoining vertical surfaces.	Match adjacent surface color
d.	Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	Match adjacent surface color
e.	Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	Match adjacent surface color
f.	Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	Match adjacent surface color

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

	LOCATION	COLOR
a.	Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b.	Joints between new and existing exterior masonry walls.	Match adjacent Surface color
c.	Masonry joints where shelf angles occur.	Match adjacent surface color
d.	Expansion and control joints.	Match adjacent surface color
e.	Voids where items pass through exterior walls.	Match adjacent surface color
f.	Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match adjacent surface color
g.	Metal-to-metal joints where sealant is indicated or specified.	Match adjacent surface color
h.	Joints between ends of gravel stops, fascias, copings, and adjacent walls.	Match adjacent surface color

2.1.3 Floor Joint Sealant

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

	LOCATION	COLOR
a.	Seats of metal thresholds for exterior doors.	Gray
b.	Control and expansion joints in floors, slabs, ceramic tile, and walkways.	Gray

2.1.4 Acoustical Sealant

Rubber or polymer-based acoustical sealant conforming to ASTM C919 must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant must have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734, and must be non-staining.

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 BACKSTOPS

Provide glass fiber roving or polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Make backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.4.1 Rubber

Conform to ASTM D 1056, Type 2, closed cell, Class A, Grade NS, round cross section for cellular rubber sponge backing.

2.4.2 Synthetic Rubber

Conform to ASTM C509, Option I, Type I preformed rods or tubes for Synthetic rubber backing.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean surfaces from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, contact sealant manufacturer for specific recommendations.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity.

3.1.4 Wood Surfaces

Keep wood surfaces to be in contact with sealants free of splinters and sawdust or other loose particles.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

a. Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry,		

stone:

1/4 inch (minimum)	1/4 inch	1/4 inch
Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
Over 1/2 inch to 2 inch	1/2 inch	5/8 inch
Over 2 inch.	(As recommended by sealant manufacturer)	

b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is not required on metal surfaces.

3.3.2 Masking Tape

Place masking tape on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Remove masking tape within 10 minutes after joint has been filled and tooled.

3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

a. Where indicated.

b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios".

3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and cannot be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the

joints solidly without air pockets. Tool sealant after application to ensure adhesion. Make sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Apply sealer over the sealant when and as specified by the sealant manufacturer.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- End of Section --

SECTION 08 11 13 STEEL

DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2010) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A879/A879M	(2006) Standard Specification for Steel Sheet, zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C578	(2011a) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2011) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM D2863	(2010) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115	(2006) Hardware Preparation in Steel Doors and Steel Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105	(2010) Standard for Installation of Smoke Door Assemblies and Other Opening Protectives
NFPA 252	(2008) Standard Methods of Fire Tests of Door Assemblies
NFPA 80	(2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111	(2009) Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories
SDI/DOOR 113	(2001; R2006) Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies
SDI/DOOR A250.11	(2001) Recommended Erection Instructions for Steel Frames
SDI/DOOR A250.3	(2007) Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
SDI/DOOR A250.4	(2001) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
SDI/DOOR A250.6	(2003; R2009) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
SDI/DOOR A250.8	(2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C	(2009) Standard for Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors;

Frames;

Weatherstripping

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors;

Schedule of frames;

Submit door and frame locations.

SD-03 Product Data

Doors;

Frames;

Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated. Provide exterior glazing in accordance with ASTM F 2248 and ASTM E1300.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors and for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

2.1.1.2 Maximum Duty Doors

SDI/DOOR A250.8, Level 4, physical performance Level A, Model 1 with core construction as required by the manufacturer for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level 4 at all exterior doors.

2.2 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with SDI/DOOR A250.4 and shall have met the requirements for Level C. Prepare doors to receive specified hardware.Doors shall be 1-3/4 inch thick. Provide insulated steel doors and frames at all exterior doors.

2.3 ACCESSORIES

2.3.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors. For interior pairs of fire rated and smoke control doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies and NFPA 105 for smoke control assemblies.

2.3.2 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or

b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or

c. Mineral board: ASTM C612, Type I.

2.5 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 3 and 4, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth. Provide at all exterior doors.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

2.5.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.5.3 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and be a member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.5.4 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.5.5 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.5.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;

b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;

c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111; and

2.5.6.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

2.6 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 shall take precedence over details indicated or specified.

2.6.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.6.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

2.6.3 Astragal on Fire and Smoke Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. On smoke control doors, conform to NFPA 105.

2.7 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

2.7.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08 71 00 DOOR HARDWARE. Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.8 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.9 FINISHES

2.9.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8, or paintable A25 galvannealed steel without primer. Where coating is removed by welding, apply touchup of factory primer.

2.9.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A924/A924Mand ASTM A653/A653M. The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8. Provide for exterior doors.

2.9.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A879/A879M, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

2.9.4 Factory-Applied Enamel Finish

Coatings shall meet test procedures and acceptance criteria in accordance with SDI/DOOR A250.3. After factory priming, apply two coats of medium-gloss enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements shall be in accordance with the

coating manufacturer's recommendations. Color(s) of finish coat shall be as indicated and shall match approved color sample(s).

2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

2.11 PROVISIONS FOR GLAZING

Materials are specified in Section 08 81 00, GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. Backfill frames with mortar. Coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean

thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

SECTION 08 11 16 ALUMINUM

DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural

Exterior doors, frames and hardware shall be designed to resist equivalent static design loads in accordance with ASTM F 1642. Frame deflections shall not exceed L/160 of the unsupported member lengths. Equivalent static design loads for connections of window or door frame to the surrounding walls or hardware and associated connections, and glazing stop connections shall be in accordance with ASTM F 2248 and ASTM E1300.Design supporting elements and their connections based on their ultimate capacities. Provide calculations of a Professional Engineer that substantiates compliance with these requirements. Use frames that provide an equivalent level of performance. Shapes and thicknesses of framing members shall be sufficient to withstand a design wind load of not less than50 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide glazing beads, moldings, and trim of not less than 0.050 inch nominal thickness.

1.2.2 Air Infiltration

When tested in accordance with ASTM E283, air infiltration shall not exceed 0.06 cubic feet per minute per square footof fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).

1.2.3 Water Penetration

When tested in accordance with ASTM E331, there shall be no water penetration at a pressure of 8 pounds per square foot of fixed area.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors, windows and frames;

Show elevations of each door type, size of doors and frames, metal gages, details of door and frame construction, methods of anchorage, glazing details, weatherstripping, provisions for and location of hardware, and details of installation.

SD-04 Samples

Finish sample;

SD-05 Design Data

Structural calculations for deflection;

SD-08 Manufacturer's Instructions

Doors and frames

Submit detail specifications and instructions for installation, adjustments, cleaning, and maintenance.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on nonabsorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

1.5 QUALITY CONTROL

1.5.1 Shop Drawing Requirements

Drawings shall indicate elevations of doors, windows and frames, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, trim, installation details, and other related items.

1.5.2 Sample Requirements

1.5.2.1 Finish Sample Requirements

Submit color chart of standard factory-finish color coatings.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members, subframes, adjoining sidelights, adjoining window wall, trim, and accessories.

2.2 MATERIALS

2.2.1 Anchors

Stainless steel.

2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.2.3 Aluminum Alloy for Doors and Frames

ASTM B221, Alloy 6063-T5 for extrusions. ASTM B209, alloy and temper best suited for aluminum sheets and strips.

2.2.4 Fasteners

Hard aluminum or stainless steel.

2.2.5 Structural Steel

ASTM A36/A36M.

2.2.6 Aluminum Paint

Aluminum door manufacturer's standard aluminum paint.

2.3 FABRICATION

2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 12 inches on center. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

2.3.2 Aluminum Doors

Of type, size, and design indicated and not less than 1-3/4 inch thick. Minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal and shall include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor. Bevel single-acting doors 0.063 or 0.125 inch at lock, hinge, and meeting stile edges.

2.3.2.1 Full Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 3/8 or 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Weld concealed reinforcements for hardware in place.

2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively. Air leakage of a single leaf weatherstripped door shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill. Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation. Place anchors near top and bottom of each jamb and at intermediate points not more than 25 inch apart.

2.3.6 Provisions for Hardware

Coordinate with Section 08 71 00 DOOR HARDWARE. Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws.

2.3.7 Provisions for Glazing

Provide extruded aluminum snap-in glazing beads on interior side of doors. Glazing beads shall have vinyl insert glazing gaskets. Design glazing beads to receive glass of thickness indicated or specified.

2.3.8 Finishes

Provide exposed aluminum surfaces with factory finish of anodic coating.

2.3.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45. Finish shall be clear (natural), designation AA-M10-C22-A41, Architectural Class I 0.7 mil or thicker).

PART 3 EXECUTION

3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors, adjoining sidelights, and adjoining window walls. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions. Anchor bottom of each frame to rough floor construction with 3/32 inch thick stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Hang doors to produce clearances specified in paragraph entitled "Aluminum Doors," of this section. After erection and glazing, adjust doors and hardware to operate properly.

3.2 PROTECTION FROM DISSIMILAR MATERIALS

3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact to dissimilar metals.

3.2.1.1 Protection

Provide one of the following systems to protect surfaces in contact with dissimilar metals:

a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.

b. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.

c. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.

d. Use a nonabsorptive tape or gasket in permanently dry locations.

3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint to prevent aluminum discoloration.

3.2.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

3.2.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting the aluminum, the Contractor shall have the option of painting the wood or other absorptive surface with two coats of aluminum paint and sealing the joints with elastomeric sealant.

3.3 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's written recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

3.4 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10	(2010; Change 2010; Change 2011) Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE FUN IP	(2009; Errata 2010) Fundamentals Handbook, I-P Edition

ASME INTERNATIONAL (ASME)

ASME B29.400	(2001; R 2008) Combination, "H" Type Mill Chains, and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A27/A27M	(2010) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A48/A48M	(2003; R 2008) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666	(2010) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F 568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA MG 1	(2009) Motors and Generators
NEMA ST 1	(1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 DESCRIPTION

Overhead coiling doors to be counterbalanced doors by methods of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members. Doors to be coiling type, with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Wind Loading

Design and fabricate door assembly to withstand the wind loading pressure of at least 50 pounds per square foot with a maximum deflection of 1/120 of the opening width. Provide test data showing compliance with ASTM E 330. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested Complete assembly must meet or exceed the requirements of ASCE 7-10.

1.3.2 Operational Cycle Life

All portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue must be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Provide fabrication drawings that show complete assembly with hardware and framing details for the following items:

Overhead Coiling Doors

Counterbalancing Mechanism

Manual Door Operators

Electric Door Operators

Bottom Bar

Guides

Mounting Brackets

Overhead Drum

Hood

Painting

Submit Installation Drawings in accordance with paragraph entitled, "Overhead Coiling Door Assemblies," of this section.

SD-03 Product Data

Submit manufacturer's catalog data for the following items listing all accessories including supports, locks and latches, and weather stripping.

Overhead Coiling Doors

Manual Door Operators

Electric Door Operators

Fire-Rated Door Assembly

SD-05 Design Data

Submit equipment and performance data for the following items in accordance with the paragraph entitled, "Performance Requirements," of this section.

Overhead Coiling Doors

Manual Door Operators

Electric Door Operators

Fire-Rated Door

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies.

1.5 OVERHEAD COILING DOOR DETAIL SHOP DRAWINGS

Provide installation drawings for overhead coiling door assemblies which show elevations of each door type, shape and thickness of materials, finishes, details of joints and connections, and details of guides and fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Show locations of replaceable fusible links wiring diagrams for power, signal and controls. Include a schedule showing the location of each door with the drawings.

Contractor must submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the Overhead Coiling Door Assemblies. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

Provide operation and maintenance manuals which are consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Provide test data that is legible and of good quality.

1.6 WARRANTY, OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies, including the following items:

Materials

Devices

Manual Door Operators

Electric Door Operators

Hood

Procedures

Manufacture's Brochures

Parts Lists

Contractor must furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship and that they will remain so for not less than two years after completion and acceptance of the project.

Contractor must warrant that upon notification by the Government, he will immediately make good any defects in material, workmanship, and door operation within the same time period covered by the guarantee, at no cost to the Government.

1.7 DELIVERY AND STORAGE

Delivered doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

PART 2 PRODUCTS

2.1 OVERHEAD COILING DOORS

2.1.1 Curtain Materials and Construction

Provide curtain slats which are fabricated from steel sheets conforming to ASTM A653/A653M, Grade A, with the additional requirement of a minimum yield point of 33,000 psi. Provide sheets which are galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M.

Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Provide slats which are continuous without splices for the width of the door.

Provide slats filled with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces on interior surface of slats.

2.1.2 Insulated Curtains

Form Curtains from manufacturer's standard shapes of interlocking slats. Supply slat system with a minimum R-value of 4 when calculated in accordance with ASHRAE FUN IP. Slats to consist of a polystyrene core not less than 11/16 inch thick, completely enclosed within metal facings. Exterior face of slats must be the same gauge as specified for curtains.

Interior face must be not lighter than 0.0219 inches. The insulated slat assembly is to have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.

2.1.3 Curtain Bottom Bar

Curtain bottom bars must be pairs of angles from the manufacturer's standard steel, stainless and aluminum extrusions not less than 2.0 by 2.0 inches by 0.188 inch.Steel extrusions must conform to ASTM A36/A36M. Stainless steel extrusions conforming to ASTM A666, Type 304. Galvanize angles and fasteners in accordance with ASTM A653/A653M and ASTM A924/A924M. Coat welds and abrasions with paint conforming to ASTM A780/A780M.

2.1.4 Locks

Provide end and/or wind locks of cast steel conforming to ASTM A27/A27M, Grade B; galvanized in accordance with ASTM A653/A653M, ASTM A153/A153M and ASTM A924/A924M and secured at every other curtain slat.

2.1.5 Weather Stripping

Weather-stripping at the door-head and jambmust be 1/8-inch thick sheet of natural or neoprene rubber with air baffles, secured to the insides of hoods with galvanized-steel fasteners through continuous galvanized-steel pressure bars at least 5/8-inch wide and 1/8-inch thick.

Threshold weather-stripping must be 1/8-inch thick sheet natural or neoprene rubber secured to the bottom bars.

Provide weather-stripping of natural or neoprene rubber conforming to ASTM D 2000.

2.1.6 Locking Devices

Slide Bolt to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

Locking Device Assembly which includes cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

Provide Chain Lock Keeper which suitable for a standard padlock.

2.1.7 Safety Interlock

Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.1.8 Overhead Drum

Fabricate drums from nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.

2.2 HARDWARE

All hardware must conform to ASTM A153/A153M, ASTM A307, ASTM F 568M, and ASTM A27/A27M.

2.2.1 Guides

Fabricate curtain jamb guides from the manufacturer's standard angles or channels of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for track adjustment.

2.2.2 Equipment Supports

Fabricate door-operating equipment supports from the manufacturer's standard steel shapes and plates conforming to ASTM A36/A36M, galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M. Size the shapes and plates in accordance with the industry standards for the size, weight, and type of door installation.

2.3 COUNTERBALANCING MECHANISM

Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

2.3.1 Brackets

Provide the manufacturer's standard mounting brackets of either cast iron or cold-rolled steel with one located at each end of the counterbalance barrel conforming to ASTM A48/A48M.

2.3.2 Counterbalance Barrels

Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 inch per foot of span under full load.

2.3.3 Spring Balance

One or more oil-tempered, heat-treated steel helical torsion springs installed within the barrel capable of producing sufficient torque to assure easy operation of the door curtain. Provide and size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

2.3.4 Torsion Rod for Counter Balance

Fabricate rod from the manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

2.4 MANUAL DOOR OPERATORS

2.4.1 Manual Chain-Hoist Door Operators

Provide door operators which consist of an endless steel hand chain, chain-pocket wheel, guard, and a geared reduction unit of at least a 3 to 1 ratio with a maximum 25 lbf required pull for operation must not exceed 35 pounds.

Provide chain hoists to have a self-locking mechanism allowing the curtain to be stopped at any point in its upward or downward travel and to remain in that position until moved to the fully open or closed position. Provide hand chains of cadmium-plated alloy steel conforming to ASME B29.400. Yield point of the chain must be at least three times the required hand-chain pull.

Provide chain sprocket wheels of cast iron conforming to ASTM A48/A48M.

2.5 ELECTRIC DOOR OPERATORS

Provide electrical wiring and door operating controls conforming to the applicable requirements of NFPA 70.

Electric door-operator assemblies must be the sizes and capacities recommended and provided by the door manufacturer for specified doors. Assemblies must be complete with electric motors and factory-prewired motor controls, starter, gear reduction units, solenoid-operated brakes, clutch, remote-control stations, manual or automatic control devices, and accessories as required for proper operation of the doors.

Design the operators so that motors may be removed without disturbing the limit-switch adjustment and affecting the emergency auxiliary operators.

Provide a manual operator of crank-gear or chain-gear mechanisms with a release clutch to permit manual operation of doors in case of power failure. Arrange the emergency manual operator so that it may be put into and out of operation from floor level, and its use will not affect the adjustment of the limit switches. Provide an electrical or mechanical device which will automatically disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged.

2.5.1 Door-Operator Types

Provide an operator which is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

Provide an operator which is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

2.5.2 Electric Motors

Provide motors which are the high-starting-torque, reversible, constant-duty electrical type with overload protection of sufficient torque and horsepower to move the door in either direction from any position and produce a door-

travel speed of not less than 8 nor more than 12 inches per second without exceeding the horsepower rating.

Provide motors which conform to NEMA MG 1 designation, temperature rating, service factor, enclosure type, and efficiency to the requirements specified.

2.5.3 Motor Bearings

Bearings must be bronze-sleeve or heavy-duty ball or roller antifriction type with full provisions for the type of thrust imposed by the specific duty load.

Pre-lubricate and factory seal bearings in motors less than 1/2 horsepower.

Equip motors coupled to worm-gear reduction units with either ball or roller bearings.

Equip bearings in motors 1/2 horsepower or larger with lubrication service fittings. Fit lubrication fittings with color-coded plastic or metal dust caps.

In any motor, bearings that are lubricated at the factory for extended duty periods do not need to be lubricated for a given number of operating hours. Display this information on an appropriate tag or label on the motor with instructions for lubrication cycle maintenance.

2.5.4 Motor Starters, Controls, and Enclosures

Each door motor must have a factory-wired, unfused, disconnect switch; a reversing, across-the-line magnetic starter with thermal overload protection; 120-volt operating coils with a control transformer limit switch; and a safety interlock assembled in a NEMA ICS 6 type enclosure as specified herein. Control equipment must conform to NEMA ICS 2.

Provide adjustable switches, electrically interlocked with the motor controls and set to stop the door automatically at the fully open and fully closed position.

2.5.5 Control Enclosures

Provide control enclosures that conform to NEMA ICS 6 for oil-tight and dust-tight NEMA Type 13.

2.5.6 Transformer

Provide starters with 230/460 to 115 volt control transformers with one secondary fuse when it is required to reduce the voltage on control circuits to 120 volts or less. Provide transformer that conforms to NEMA ST 1.

2.5.7 Safety-Edge Device

Provide each door with a pneumatic safety device extending the full width of the door and located within a U-section neoprene or rubber astragal mounted on the bottom rail of the bottom door section. Device must immediately stop and reverse the door upon contact with an obstruction in the door opening

during downward travel and cause the door to return to full-open position. Safety device is not a substitute for a limit switch.

Connect safety device to the control circuit through a retracting safety cord and reel.

2.5.8 Remote-Control Stations

Provide interior remote control stations which are full-guarded, momentary-contact three-button, heavy-duty, surface-mounted NEMA ICS 6 type enclosures as specified. Mark buttons "OPEN," "CLOSE," and "STOP." The "CLOSE" button must be the type requiring a constant pressure to maintain the closing motion of the door. When the door is in motion and the "STOP" button is pressed, the door must stop instantly and remain in the stopped position; from the stopped position, the door may then be operated in either direction.

2.5.9 Speed-Reduction Units

Provide speed-reduction units consisting of hardened-steel worm and bronze worm gear assemblies running in oil or grease and encased in a sealed casing, coupled to the motor through a flexible coupling. Drive shafts must rotate on ball- or roller-bearing assemblies that are integral with the unit.

Provide minimum ratings of speed reduction units which are in accordance with AGMA provisions for class of service.

Ground worm gears to provide accurate thread form; machine teeth for all other types of gearing. Surface harden all gears.

Provide bearings which are the antifriction type equipped with oil seals.

2.5.10 Chain Drives

Provide roller chains that are power-transmission series steel roller type conforming to ASME B29.400, with a minimum safety factor of 10 times the design load.

Roller-chain side bars, rollers, pins, and bushings must be heat-treated or otherwise hardened.

Provide chain sprockets that are high-carbon steel with machine-cut hardened teeth, finished bore and keyseat, and hollow-head setscrews.

2.5.11 Brakes

Provide brakes which are 360-degree shoe brakes or shoe and drum brakes, solenoid-operated and electrically interlocked to the control circuit to set automatically when power is interrupted.

2.5.12 Clutches

Clutches must be the 4-inch diameter, multiple face, externally adjustable friction type or adjustable centrifugal type.

2.6 SURFACE FINISHING

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 GENERAL

Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, doors must be free from all distortion.

Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the contract documents and as required by the manufacturer.

Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

3.2 FIELD PAINTED FINISH

Steel doors and frames which are to be field painted must accordance with Section 09 90 00 PAINTS AND COATINGS and manufacturer's written instructions. Protect weather stripping from paint. Finishes must be free of scratches or other blemishes.

3.3 ACCEPTANCE PROVISIONS

After installation, adjust hardware and moving parts. Lubricate bearings and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

Adjust seals to provide weather-tight fit around entire perimeter.

Engage a factory-authorized service representative to perform startup service and checks according to manufacturer's written instructions.

Test the door opening and closing operation when activated by controls or alarm-connected fire-release system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset door-closing mechanism after successful test.

Test and make final adjustment of new doors at no additional cost to the Government.

3.3.1 Maintenance and Adjustment

Not more than 90 calendar days after completion and acceptance of the project, the Contractor must examine, lubricate, test, and re-adjust doors as required for proper operation.

3.3.2 CLEANING

Clean doors in accordance with manufacturer's approved instructions.

-- End of Section --

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

This Specification includes aluminum entrances, glass and glazing, door hardware, and components.

Type of Aluminum Entrance includes:

Impact Resistance Entrances; medium stile, 3-1/2 inch vertical face dimension, 1-3/4 inch depth, interior structural silicone glazed, high traffic/impact resistant applications.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1503	(2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
AAMA 501	(2005) Methods of Test for Exterior Walls
AAMA 503	(2008) Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems
AAMA 800	(2010) Voluntary Specifications and Test Methods for Sealants

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2009; Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10	(2010; Change 2010; Change 2011) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B221M	(2007) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM E 1105	(2000; R 2008) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
ASTM E 1424	(1991; R 2008) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen
ASTM E 1886	(2005) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 783	(2002; R 2010) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.10	(2011) Power Operated Pedestrian Doors
ANSI/BHMA A156.4	(2008) Door Controls - Closers

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201 Safety Standard for Architectural Glazing Materials

UNDERWRITERS LABORATORIES (UL)

UL 325 (2002; Reprint Apr 2011) Door, Drapery, Gate, Louver, and Window Operators and Systems

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Entrance Performance Requirements

1.3.1.1 Air Infiltration

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. For single acting offset pivot, butt hung or continuous geared hinge entrances in the closed and locked position, test the specimen in accordance with ANSI/BHMA A156.10, and ASTM E 283 at a pressure differential of 1.57 psf for pairs of doors; maximum infiltration for a pair of 7 foot - 0 inch by 8 foot - 0 inch entrance doors and frame is 1.2 cfm/ft2.

b. Maximum allowable infiltration, for a completed storefront system is not to exceed 0.06 cfm/square foot when tested in accordance with ASTM E 1424 at differential static pressure of 6.24 psf.

1.3.1.2 Wind Loads

Provide completed storefront system capable of withstanding wind pressure loads, normal to the wall plane indicated, as follows:

a. Exterior Walls

(1) Positive Pressure: 50 psf

(2) Negative Pressure: 30 psf

b. Interior Walls: (pressure acting in either direction) 5 psf

1.3.1.3 Deflection

Submit certified test reports showing compliance with specified performance characteristics as follows:

The maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures is L/175 or 3/4 inches maximum.

1.3.1.4 Condensation Resistance and Thermal Transmittance Performance Requirements

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. U-Value Requirements:

(1) Perform test in accordance with AAMA 1503 procedure and on the configuration specified therein.

(2) Thermal Transmittance ("U" Value) maximum 0.65 (6250) BTU/hr/sf/deg F at 15 mph exterior wind.

b. CRF Class Requirements:

(1) Perform test in accordance with AAMA 1503.

(2) Condensation Resistance Factor Requirements (CRF) minimum 42.

1.3.1.5 Water Infiltration

Submit certified test reports showing compliance with specified performance characteristics as follows:

System is designed to provide no uncontrolled water when tested in accordance with ASTM E 331 at a static pressure of 8 psf.

1.3.2 Structural

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. Corner strength per dual moment load test procedure and obtain certification by an independent testing laboratory to ensure weld compliance and corner integrity.

b. Test and certify test results per AAMA 503, ASTM E 1105, ASTM E 783, ASTM E 331, and make available upon request.

1.3.2.1 Uniform Load

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. Apply a static air design load of (<MET>3.11 kilopascal for</MET> 85 psf (65 psf for 9/16 inch laminated infill) in the positive and negative direction in accordance with AAMA 501, and ASTM E 330.

b. No deflections are allowed to exceed l/180 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage is allowed.

1.3.2.2 Impact Resistance

Submit certified test reports showing compliance with specified performance characteristics as follows:

Large Missile, tested in accordance with ASTM E 1886 at a door opening of 7 foot - 0 inch by 8 foot - 0 inch.

1.3.2.3 Forced Entry

Submit certified test reports showing compliance with specified performance characteristics as follows:

Test in accordance with ASTM F 1642

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Sample Warranty;

Listing of Product Installations;

SD-02 Shop Drawings

Installation Drawings;

SD-03 Product Data

Manufacturer's Catalog Data

SD-04 Samples

Finish and Color Samples;

SD-06 Test Reports

Certified Test Reports;

SD-07 Certificates

Manufacturer's Product Warranty;

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Installer Qualifications

Provide documentation of Installer experience to perform work of this section, who has specialized in the installation of work similar to that required for this project, and who is acceptable to product manufacturer.

1.5.1.2 Manufacturer Qualifications

Ensure manufacturer is capable of providing field service representation during construction, approving acceptable installer and approving application method.

1.5.2 Pre-Installation Meetings

Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.5.3 Single Source Responsibility

Provide design, structural engineering, and custom fabrication for door portal system and supply of all components, materials, and products based on a single manufacturer of sole responsibility. Provision of products from numerous sources for site assembly without complete single source design and supply responsibility is not acceptable. Work items and components to be fabricated or supplied by single source are:

a. Door assemblies.

b. Glazed wall to be constructed around door portal as specified in this Section.

c. Door operating hardware to be installed on or within door portal as specified in Section 08 71 00 DOOR HARDWARE.

d. Glass as specified in Section 08 81 00 GLAZING.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Ordering

Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

1.6.2 Packing, Shipping, Handling and Unloading

Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.6.3 Storage and Protection

Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

1.7 PROJECT CONDITIONS/ SITE CONDITIONS

1.7.1 Field Measurements

Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication scheduled with construction progress to avoid construction delays.

1.8 DESIGN AND PERFORMANCE CRITERIA

Design, size components, and install door portal system to withstand these loads without breakage, loss, failure of seals, product deterioration, and other defects.

a. Dead and Live Loads: Determined by ASCE 7-10 and calculated in accordance with applicable codes.

b. Seismic loads: Design and install system to comply with applicable seismic requirements for project location as defined by Section 1613 of the International Building Code (IBC).

c. Effects of applicable wind load acting inward and outward normal to plane of wall in accordance with ASTM E 330.

d. Thermal loads and movement:

(1) Ambient temperature range: 120 degrees F.

(2) Material surfaces range: 180 degrees F.

e. Provide and install weatherstripping, exterior gaskets, sealants, and other accessories to resist water and air penetration.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum (Entrances and Components)

2.1.1.1 Material Standard

ASTM B221 ASTM B221M; 6063-T5 alloy and tempered

Provide door stile and rail face dimensions of the entrance doors as follows:

Vertical Stile	Top Rail	Bottom Rail
3-1/2 inches	3-1/2 inches	6-1/2 inches

Provide major portions of the door members at.125 inches nominal in thickness and glazing molding to be .050 inches thick.

2.1.1.2 Tolerances

Reference to tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by The Aluminum Association.

Provide either EPDM elastomeric extrusions or thermoplastic elastomer glazing gaskets. Structural silicone sealant is required.

2.2 MANUFACTURERS

Manufacturers are acceptable providing they meet the requirements specified in this section and project drawings.

2.3 ACCESSORIES

2.3.1 Fasteners

Provide stainless steel where exposed.

2.3.2 Perimeter Anchors

When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

2.3.3 Standard Entrance Hardware

2.3.3.1 Weatherstripping

Equip meeting stiles on pairs of doors with an adjustable astragal utilizing wool pile with polymeric fin.

Provide door weatherstripping on a single acting offset pivot or butt hung door and frame (single or pairs) comprised of a thermoplastic elastomer weatherstripping on a tubular shape with a semi-rigid polymeric backing.

Provide Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Provide as necessary to meet specified performance tests.)

2.3.3.2 Threshold

Provide extruded aluminum threshold, one piece per door opening, with ribbed surface.

2.3.3.3 Offset Pivots

Provide manufacturer's standard top and bottom pivots with one intermediate offset pivot.

2.3.3.4 Panic Device

Provide manufacturer's recommended standard panic hardware.

2.3.3.5 Closer

Provide surface closer only per ANSI/BHMA A156.4.

2.3.3.6 Security Lock/Dead Lock

Provide A/R MS 1850A lock with (2) A/R 1871 cylinder operated flush bolts.

2.3.3.7 Cylinder(s)/Thumb-turn

Provide manufacturer's recommended standard.

2.3.3.8 Cylinder Guard

Manufacturer standard.

2.4 RELATED MATERIALS

2.4.1 Sealants

Refer to Section 07 92 00 JOINT SEALANTS. Ensure all sealants conform to AAMA 800.

2.4.2 Glass

Refer to Section 08 81 00 GLAZING.

2.5 FABRICATION

2.5.1 Entrance System Fabrication

Provide door corner construction consisting of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Provide hook-in type exterior glazing stop with EPDM glazing gaskets reinforced with non-stretchable cord. Provide interior glazing stop mechanically fastened to the door member incorporating a silicone compatible spacer used with silicone sealant.

Accurately fit and secure joints and corners. Make joints hairline in appearance. Prepare components with internal reinforcement for door hardware. Arrange fasteners and attachments to conceal from view.

2.5.2 Shop Assembly

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

2.5.2.1 Welding

Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.5.3 Fabrication Tolerance

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances.

2.5.3.1 Material Cuts

Square to 1/32 inch off square, over largest dimension; proportionate amount of 1/32 inch on the two dimensions.

2.5.3.2 Maximum Offset

1/64 inch in alignment between two consecutive members in line, end to end.

2.5.3.3 Maximum Offset

1/64 inch between framing members at glazing pocket corners.

2.5.3.4 Joints

(Between adjacent members in same assembly: Hairline and square to adjacent member.

2.5.3.5 Variation

In squaring diagonals for doors and fabricated assemblies: 1/16 inch.

2.5.3.6 Flatness

For doors and fabricated assemblies: plus/minus 1/16 inch of neutral plane.

2.6 SOURCE QUALITY CONTROL

2.6.1 Source Quality

Provide aluminum entrances specified herein from a single source.

2.6.1.1 Building Enclosure System

When aluminum entrances are part of a building enclosure system, including storefront framing, windows, curtain wall system and related products, provide building enclosure system products from a single source manufacturer.

2.6.2 Fabrication Tolerances

Fabricate aluminum entrances in accordance with entrance manufacturer's prescribed tolerances.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Site Verification of Conditions

Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer's acceptable tolerances.

3.1.2 Field Measurements

Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.2 INSTALLATION

Install entrance system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten system to building structure. Align assembly

plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

Set thresholds in bed of mastic and secure. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylatron pads or bituminous coating. Shim and brace aluminum system before anchoring to structure. Verify weep holes are open, and metal joints are sealed in accordance with manufacturer's installation instructions. Seal metal to metal joints using sealant recommended by system manufacturer.

3.2.1 Preparation

Field verify dimensions prior to fabricating door portal assembly components.

Coordinate requirements for locations of blockouts for anchorage of door portal columns and other embedded components with Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

Coordinate erection of door portal with installation of surrounding glass wall and door assemblies. Ensure adequate provision is made for support and anchorage of assembly components.

Coordinate electrical requirements for electrified door hardware to ensure proper power source, conduit, wiring, and boxes.

3.2.1.1 Adjacent Surfaces Protection

Protect adjacent work areas and finish surfaces from damage during product installation.

3.2.1.2 Aluminum Surface Protection

Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.2.2 Adjusting

Adjust operating hardware for smooth operation, and as recommended by the manufacturer.

3.2.3 Related Products Installation Requirements

3.2.3.1 Sealants (Perimeter)

Refer to Section 07 92 00 JOINT SEALANTS.

3.2.3.2 Glass

Refer to Section 08 81 00 GLAZING.

3.2.3.3 Reference

ANSI Z97.1, 16 CFR 1201 and GANA Glazing Manual.

3.3 PROTECTION AND CLEANING

3.3.1 Protection

Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

3.3.2 Cleaning

Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.4 WARRANTY

Submit three signed copies of manufacturer's product warranty for entrance system as follows:

Warranty Period: Two years from Date of Substantial Completion of the project, provided that the Limited Warranty begins in no event later than six months from date of shipment by manufacturer. In addition, support welded door corner construction with a limited lifetime warranty for the life of the door under normal use.

Ensure Warranty language is identical to "As Approved" version of the sample warranty submitted and returned from the Contracting Officer.

-- End of Section --

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1302.5	(1976) Voluntary Specifications for Forced-Entry Resistant Aluminum Prime Windows
AAMA 1503	(2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
AAMA 611	(1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum
AAMA/WDMA/CSA 101/I.S.2/A440	(2008; Update 1 2008; Update 2 2008; Update 3 2009) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

ASTM INTERNATIONAL (ASTM)

ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM E 1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM F 1642	(2004; R 2010) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F 2248	(2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

GREEN SEAL (GS)

GS-36	(2000) Commercial Adhesives

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2010) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

1.2 CERTIFICATION

Each prime window unit must bear the AAMA Label warranting that the product complies with AAMA/WDMA/CSA 101/I.S.2/A440. Certified test reports attesting that the prime window units meet the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows;

Fabrication Drawings

SD-03 Product Data

Windows;

Hardware;

Fasteners;

Window performance;

Thermal-Barrier Windows;

Mullions;

SD-04 Samples

Finish Sample;

Window Sample;

SD-05 Design Data

Structural calculations for deflection;

Design Analysis;

Submit design analysis with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the minimum antiterrorism standards required by paragraph "Minimum Antiterrorism Performance", unless conformance is demonstrated by Standard Airblast Test results. Calculations verifying the structural performance of each window proposed for use, under the given loads, shall be prepared and signed by a registered Professional Engineer. The window components and anchorage devices to the structure, as determined by the design analysis, shall be reflected in the shop drawings.

SD-06 Test Reports

Minimum condensation resistance factor

Resistance to forced entry

Standard Airblast Test; G

For Minimum hurricane resistant windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shocktube, shall be included in a test report, providing information in accordance with ASTM F 1642, as prepared by the independent testing agency performing the test. The test results shall demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph "Standard Airblast Test Method".

SD-10 Operation and Maintenance Data

Windows.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, material and method of attaching subframes, stools, casings, sills, trim, installation details, and other related items.

1.4.2 Sample Requirements

1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

1.4.2.2 Window Sample Requirements

Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

1.4.3 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements. A registered Professional Engineer must provide calculations.

Submit design analysis with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the requirements. Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

1.4.4 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, and minimum condensation resistance factor (CRF), and resistance to forced entry.

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which calking and glazing compounds must adhere.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.8 FIELD MEASUREMENTS

Take field measurements prior to preparation of the drawings and fabrication.

1.9 PERFORMANCE REQUIREMENTS

1.9.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least 50 pounds per square foot (psf).

1.9.2 Tests

Test windows proposed for use in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

1.10 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

1.11 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.11.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

1.11.2 Air Infiltration

Air infiltration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.3 Water Penetration

Water penetration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.4 Thermal Performance

Non-residential aluminum windows (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of 0.25 determined according to NFRC 200 procedures and a U-factor maximum of 0.65 Btu/hr-ft^2-F in accordance with NFRC 100.

1.12 QUALIFICATION

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 10 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.13 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

Provide prime windows that comply with AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. In addition to compliance with AAMA/WDMA/CSA 101/I.S.2/A440, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds L/175 of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 42 when tested in accordance with AAMA 1503.

2.1.1 Fixed Windows (F)

Type F-R15.

2.1.2 Forced Entry Resistant Windows

In addition to meeting the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, windows designated for resistance to forced entry must conform to the requirements of AAMA 1302.5.

2.1.3 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

2.1.4 Calking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

2.1.5 Weatherstripping

AAMA/WDMA/CSA 101/I.S.2/A440.

2.2 FABRICATION

Fabrication of window units must comply with AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown.

2.2.2 Weatherstripping

Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) compression-type weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do no use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.

2.2.3 Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

2.2.4 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials, GS-36, SCAQMD Rule 1168, and as specified in Section 07 92 00 JOINT SEALANTS.

2.2.5 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

2.2.6 Combination Windows

Windows used in combination must be the same class and grade and will be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.7 Mullions and Transom Bars

Provide mullions between multiple window units to resist two times (2X) glazing resistance in accordance with ASTM F 2248 and ASTM E 1300. Provide mullions with a thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

2.2.8 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete

installation and proper operation. Furnish extruded aluminum subframe receptors and subsill with each window unit.

2.2.8.1 Hardware

AAMA/WDMA/CSA 101/I.S.2/A440. The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.8.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

2.2.9 Finishes

Exposed aluminum surfaces must be factory finished with an anodic coating. Color must be clear. All windows will have the same finish.

2.2.9.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

b. Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A41, clear (natural) anodized.

2.3 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

a. Aluminum alloy must be 6063-T6.

b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors will not bridge the connection between the inner and outer frame.

2.4 MULLIONS

Provide mullions between multiple-window units where indicated.

Mullions and mullion covers must be the profile indicated, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or

pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members shall be fabricated of the materials specified in AAMA/WDMA/CSA 101/I.S.2/A440 and meet the specified design loading.

PART 3 TITLE

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to AAMA/WDMA/CSA 101/I.S.2/A440. Do not coat surfaces in contact with sealants after installation with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM F 883	(2009) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2006) Butts and Hinges
ANSI/BHMA A156.13	(2005) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.15	(2006) Release Devices Closer Holder, Electromagnetic and Electromechanical
ANSI/BHMA A156.16	(2008) Auxiliary Hardware
ANSI/BHMA A156.18	(2006) Materials and Finishes
ANSI/BHMA A156.21	(2009) Thresholds
ANSI/BHMA A156.22	(2005) Door Gasketing and Edge Seal Systems
ANSI/BHMA A156.3	(2008) Exit Devices
ANSI/BHMA A156.4	(2008) Door Controls - Closers
ANSI/BHMA A156.5	(2010) Auxiliary Locks and Associated Products
ANSI/BHMA A156.6	(2010) Architectural Door Trim
ANSI/BHMA A156.7	(2003; R 2009) Template Hinge Dimensions
ANSI/BHMA A156.8	(2010) Door Controls - Overhead Stops and Holders

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2012) Life Safety Code

NFPA 80 (2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2011) Building Materials Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hardware schedule;

Keying system;

SD-03 Product Data

Hardware items;

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule items,

Submit data package in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Key Bitting

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designation

1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys (AA1, AA2, etc.).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, pivots, and closers of one lock, hinge, pivot, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.5.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware subcontractor, using Activity and Base Locksmith shall meet to discuss key requirements for the facility.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Provide hardware to be applied to metal or to prefinished doors manufactured to template. Promptly furnish template information or templates to door and frame manufacturers. Conform to ANSI/BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements indicated, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Provide the label of Underwriters Laboratories, Inc. for such hardware listed in UL Bld Mat Dir or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the

identifying mark will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

ANSI/BHMA A156.1, 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

2.3.2 Pivots

ANSI/BHMA A156.4.

2.3.3 Locks and Latches

2.3.3.1 Mortise Locks and Latches

ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Install knobs and roses of mortise locks with screwless shanks and no exposed screws.

2.3.4 Exit Devices

ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide touch bars in lieu of conventional crossbars and arms. Provide escutcheons, not less than 7 by 2-1/4 inch.

2.3.5 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Provide cylinders and cores with seven pin tumblers. Provide cylinders from products of one manufacturer, and provide cores from the products of one manufacturer. Mortise cylinders have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core. Provide cylinders for new locks, including locks provided under other sections of this specification. Provide fully compatible cylinders with products of the Best Lock Corporation with interchangeable cores which are removable by a special control key. Factory set the cores with seven pin tumblers using the A4 system and F keyway. Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores.

2.3.6 Keying System

The Government will provide permanent cylinders with cores and keys for mortise locksets, auxiliary locks, and exit devices. Furnish cylinders as manufactured by Best Lock Corp., Arrow Lock Corp., or Falcon Lock. Coordinate delivery schedule with FLETC Lock and Key Department and the COR. Provide temporary cores and keys for the Contractor's use during construction, and for testing the locksets.

2.3.7 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

2.3.7.1 Lever Handles

Provide lever handles in lieu of knobs where indicated in paragraph entitled "Hardware Schedule". Conform to the minimum requirements of ANSI/BHMA A156.13 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

2.3.7.2 Texture

Provide knurled or abrasive coated knobs or lever handles where specified in paragraph entitled "Hardware Schedule".

2.3.8 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room number on keys.

Furnish seven change keys for each interchangeable core, furnish two control keys, six masters keys, and six construction master keys. Furnish a quantity of key blanks equal to 20 percent of the total number of change keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room numbers on keys.

2.3.9 Door Bolts

ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: ANSI/BHMA A156.3, Type 25.

2.3.10 Closers

ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, except at storefront mounting, pivots, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

2.3.10.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.3.11 Overhead Holders

ANSI/BHMA A156.8.

2.3.12 Closer Holder-Release Devices

ANSI/BHMA A156.15.

2.3.13 Door Protection Plates

ANSI/BHMA A156.6.

2.3.13.1 Sizes of Armor Mop and Kick Plates

2 inch less than door width for single doors; one inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors. Provide a minimum 36 inch armor plates for flush doors, except 16 inch high armor plates on fire doors.Provide 6 inch mop plates.

2.3.14 Door Stops and Silencers

ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.15 Padlocks

ASTM F 883.

2.3.16 Thresholds

ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.17 Weather Stripping Gasketing

ANSI/BHMA A156.22. Provide the type and function designation where specified in paragraph entitled "Hardware Schedule". Provide a set to include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors not to exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Provide weather stripping with one of the following:

2.3.17.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

2.3.17.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

2.3.17.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

2.3.18 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant and fasten with stainless steel screws.

2.3.18.1 Door Rain Drips

Approximately 1-1/2 inch high by 5/8 inch projection. Align bottom with bottom edge of door.

2.3.18.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

2.3.19 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Provide stainless steel or nonferrous metal fasteners that are exposed to weather. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISHES

ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint finish for surface door closers, and except BHMA 652 finish (satin chromium plated) for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

2.6 KEY CABINET AND CONTROL SYSTEM

ANSI/BHMA A156.5, Type E8351 (150 hooks).

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping to prevent damage. Provide full contact, weather-tight seals. Operate doors without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 9 inch on center after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door 1 inch on center and to heads and jambs at 4 inch on center

3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 1-1/2 inch on center.

3.1.2 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

3.3 HARDWARE LOCATIONS

SDI/DOOR A250.8, unless indicated or specified otherwise.

a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.

b. Mop Plates: Bottom flush with bottom of door.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct,

repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

Provide hardware for aluminum doors under this section. Deliver Hardware templates and hardware, except field-applied hardware to the aluminum door and frame manufacturer for use in fabricating the doors and frames.

Below are examples of some typical hardware sets. Each task order will identify hardware set requirements:

HW-1 (EXTERIOR ENTRY)

PIVOTS		--	BY DOOR MFG.
1 EXIT DEVICE	PANELINE, CONCEALED ROD	--	KAWNEER
1 PULL	12" PULL	--	BY DOOR MFG.
1 CYLINDERS	1E74-C4	612	BEST
1 CLOSER	CONCEALED, OVERHEAD	--	BY DOOR MFG.
1 THRESHOLD	2005AT	--	PEMKO
1 DOOR SWEEP	90137CNB	--	PEMKO
1 SET WEATHERSTRIPING		--	BY DOOR MFG.

HW-2 (EXTERIOR ENTRY - PAIR)

PIVOTS		--	BY DOOR MFG.
2 PULL	12" PULL	--	BY DOOR MFG.
1 CYLINDERS	1E74-C4	612	BEST
2 CLOSER	CONCEALED, OVERHEAD	--	BY DOOR MFG.
2 THRESHOLD	2005AT	--	PEMKO
2 DOOR SWEEP	90137CNB	--	PEMKO
2 SET WEATHERSTRIPING		--	BY DOOR MFG.
1 COMBINATION FLUSH BOLT SET		--	BY DOOR MFG.

HW-3 (CORRIDOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 CLOSER	351-O	626 SARGENT
1 STOP	409 OR 440	626 ROCKWOOD
3 SILENCERS	608	GRAY ROCKWOOD

HW-4 (ROOM 109 SERVICE COUNTER)

3 EACH DOUBLE ACTION HINGES	4-1/2 x 4-1/2	626 HAGAR
2 PUSH PLATES	12 INCH PUSH PLATE	626 ROCKWOOD
1 STOP	409 OR 440	626 ROCKWOOD
1 CYLINDER	1E74-C4	612 BEST

HW-5 (DRESSING ROOMS)

3 EACH HINGES	ECBB1101 4-1/2 BY 4-1/2	626 HAGAR
1 LOCKSET PRIVACY	45H7R14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 OR 440	626 ROCKWOOD

3 SILENCERS	608	GRAY ROCKWOOD

HW-6 (INTERIOR CONFERENCE ROOM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7R14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-7 (INTERIOR OFFICE)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7AT14J	626 BEST
1 COAT HOOK (off. side)	790	626 ROCKWOOD
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-8 (INTERIOR DOUBLE DOORS)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
2 CLOSERS	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD

HW-9 (EXTERIOR SECURE ELEC.)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD
1 HEAD DRIP		PEMKO
1 SET WEATHERSTRIPPING		PEMKO
1 DOOR SWEEP	90137CNB	PEMKO

CARD READER TO BE INSTALLED BY OTHERS

HW-10 (INTERIOR SECURE COMM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

CARD READER TO BE INSTALLED BY OTHERS

HW-11 (INTERIOR STORAGE)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-12 (MAILROOM)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET	45H7D14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-13 (EGRESS DOOR - INTERIOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (EGRESS FUNCTION)	45H7D14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD

HW-14 (EXTERIOR PAIR)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (STORAGE)	45H7A14J	626 BEST
2 CLOSERS	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD
1 ASTREGAL		626
1 THRESHOLD	2005AT	PEMKO
2 DOOR SWEEP	90137CNB	PEMKO
2 SETS WEATHERSTRIPPING		PEMKO

HW-14A (EXTERIOR PAIR)

8 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
2 EXIT DEVICE	PANELINE, CONCEALED ROD	US28 DOOR-O-MATIC
2 CLOSER	351-H	626 SARGENT
1 COMBINATION FLUSH BOLT SET	1945	626 ROCKWOOD
2 STOPS	409 or 440	626 ROCKWOOD
2 SILENCERS	608	Gray ROCKWOOD
1 ASTREGAL		626
1 THRESHOLD	2005AT	PEMKO
2 DOOR SWEEP	90137CNB	PEMKO
2 SETS WEATHERSTRIPPING		PEMKO

CARD READER TO BE INSTALLED BY OTHERS

HW-15 (EGRESS DOOR - EXTERIOR)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626 HAGAR
1 LOCKSET (EGRESS FUNCTION)	45H7A14J	626 BEST
1 CLOSER	351-O	626 SARGENT
1 STOP	409 or 440	626 ROCKWOOD
3 SILENCERS	608	Gray ROCKWOOD
1 HEAD DRIP		PEMKO
1 SET WEATHERSTRIPPING		PEMKO
1 DOOR SWEEP	90137CNB	PEMKO

1 THRESHOLD	2005AT	PEMKO	

HW-16 (TOILET & BREAK ROOMS)

3 EACH HINGES	ECBB1101 4-1/2 x 4-1/2	626	HAGAR
1 SET PUSH /PULL	12 INCH PULL, PUSH PLATE	626	ROCKWOOD
1 STOP	409 or 440	626	ROCKWOOD
3 SILENCERS	608	Gray	ROCKWOOD

-- End of Section --

SECTION 08 81 00

GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2009; Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

ASTM INTERNATIONAL (ASTM)

ASTM C1036	(2011) Standard Specification for Flat Glass
ASTM C1048	(2004) Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM C1172	(2009e1) Standard Specification for Laminated Architectural Flat Glass
ASTM C1184	(2005) Standard Specification for Structural Silicone Sealants
ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C864	(2005; R 2011) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D2287	(2011) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D395	(2003; R 2008) Standard Test Methods for Rubber Property - Compression Set
ASTM E119	(2011a) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1300	(2009a) Determining Load Resistance of Glass in Buildings
ASTM E2129	(2010) Standard Practice for Data Collection for Sustainability Assessment of Building Products

ASTM E413	(2010) Rating Sound Insulation
ASTM E90	(2009) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual
GANA Standards Manual	(2001) Tempering Division's Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-3001	(1990) Guidelines for Sloped Glazing
IGMA TM-3000	(1997) Glazing Guidelines for Sealed Insulating Glass Units
IGMA TR-1200	(1983) Commercial Insulating Glass Dimensional Tolerances

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2010) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

SD-03 Product Data

Insulating Glass

Documentation for Energy Star qualifications.

Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Samples

Insulating Glass;

Sealant;

Two 8 by 10 inch samples of each of the following: tinted glass, patterned glass, heat-absorbing glass, and insulating glass units.

Two samples of each indicated material. Samples of plastic sheets shall be minimum 5 by 7 inches.

SD-07 Certificates

Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

SD-08 Manufacturer's Instructions

Setting and sealing materials

Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

SD-11 Closeout Submittals

Insulated Glass Warranty

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in

accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E1300.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.7 WARRANTY

1.7.1 Warranty for Insulating Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

PART 2 PRODUCTS

2.1 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Clear Glass

For interior glazing (i.e., pass and observation windows), 1/4 inch thick glass should be used.

Type I, Class 1 (clear), Quality q4 (A). Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 1/8 inch float glass for openings up to and including 15 square feet, 3/16 inch for glazing openings over 15 square feet but not over 30 square feet, and 1/4 inch for glazing openings over 30 square feet but not over 45 square feet.

2.1.2 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - tinted, Quality q3 - glazing select, 40 percent light transmittance, .67 percent shading coefficient, conforming to ASTM C1036. Color shall be gray.

2.1.3 Laminated Glass

ASTM C1172, Kind LA fabricated from two nominal 1/8 inchpieces of Type I, Class 1, Quality q3, flat annealed transparent glass conforming to ASTM C1036. Flat glass shall be laminated together with a minimum of 0.030 inch thick, clear polyvinyl butyral interlayer. The total thickness shall be nominally 1/4 inch.

2.1.4 Mirrors

2.1.4.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.1.5 Tempered Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 2 (tinted heat absorbing), Quality q3, 1/4 inch thick, 40 percent light transmittance, .67 percent shading coefficient conforming to ASTM C1048 and GANA Standards Manual. Color shall be gray.

2.1.6 Fire/Safety Rated Glass

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass shall have a 45 minute rating when tested in accordance with ASTM E119. Glass shall be permanently labeled with appropriate markings.

2.2 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated 1/2 inch airspace, filled with argon gas, and hermetically sealed. Non-residential glazed systems (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of .35 determined according to NFRC 200 procedures and a U-factor maximum of .70 Btu/hr-ft2-F in accordance with NFRC 100. Glazing shall meet or exceed a luminous efficacy of 1.0.Glazed panels shall be rated for not less than 30 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

Two panes of glass separated by a dehydrated airspace and hermetically sealed. Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

2.2.1 Buildings

Two panes of glass separated by a dehydrated airspace, filled with argon gas and hermetically sealed.

Insulated glass units shall have a Solar Heat Gain Coefficient (SHGC) maximum of .35 and a U-factor maximum of .70 Btu per square foot by hr by degree F.

Glazing shall meet or exceed a luminous efficacy of 1.0. Glazed panels shall be rated for not less than 30 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

The inner light shall be ASTM C1172, clear annealed flat glass Type I, Class I, Quality q3, 1/4 inch thick. The outer light shall be ASTM C1172, Type I, Class 1, Quality q3, 1/8 inch thick, flat glass laminated together with 0.030 inch thick clear PVB interlayer, total thickness shall be 1/4 inch.

2.2.2 Low Emissivity Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 2-tinted with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C1036. Glass performance shall be U value maximum of .70 Btu/hr-ft2-F, Solar Heat Gain Coefficient (SHGC) maximum of.35. Color shall be gray.

2.3 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, IGMA TM-3000, IGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.

2.3.1 Putty and Glazing Compound

Glazing compound shall be as recommended by manufacturer for face-glazing metal sash. Putty shall be linseed oil type. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.3.2 Glazing Compound

Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

2.3.3 Sealants

Provide elastomeric and structural sealants.

2.3.3.1 Elastomeric Sealant

ASTM C920, Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units. Color of sealant shall be white.

2.3.3.2 Structural Sealant

ASTM C1184, Type S.

2.3.4 Joint Backer

Joint backer shall have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

2.3.5 Preformed Channels

Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.

2.3.6 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with ASTM D2287. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

2.3.7 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks shall be dense extruded type conforming to ASTM C509 and ASTM D395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (plus or minus 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer. Block color shall be black.

2.3.8 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.3.8.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C509, Type 2, Option 1.

2.3.8.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C864, Option 1, Shore A durometer between 65 and 75.

2.3.8.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.3.9 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

2.4 MIRROR ACCESSORIES

2.4.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.4.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 1-1/4 by 1/4 by 1/4 inch continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.4.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

PART 3 EXECUTION

3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work.Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.2.2 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of IGMA TB-3001 and IGMA TM-3000.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass.Upon removal, separate protective materials for reuse or recycling. Glass units which are broken, chipped,

cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

SECTION 08 91 00

METAL WALL LOUVERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2007) Laboratory Methods of Testing Dampers for Rating
AMCA 511	(2010) Certified Ratings Program for Air Control Devices

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611	(1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers;

SD-03 Product Data

Metal Wall Louvers;

SD-04 Samples

Wall louvers;

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.5 COLOR SAMPLES

Colors of finishes for wall louvers and door louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Galvanized Steel Sheet

ASTM A653/A653M, coating designation G90.

2.1.2 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

2.1.3 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

2.1.4 Cold Rolled Steel Sheet

ASTM A1008/A1008M, Class 1, with matte finish. Use for interior louvers only.

2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than 50 pounds per square foot. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. The rating shall

show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.

2.2.2 Formed Metal Louvers

Formed of zinc-coated steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 0.08 inch thick.

2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions where indicated for all louvers more than 5 feet in width at not more than 5 feet on centers. Provide mullions covers on both faces of joints between louvers.

2.2.4 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. For steel louvers, provide 1/2 inch square mesh, 12 or 16 gage zinc-coated steel; 1/2 inch square mesh, 16 gage copper; or 1/4 inch square mesh, 16 gage zinc-coated steel or copper bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be clear.

2.4.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish shall be:

a. Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A41, clear (natural) anodized.

2.4.2 Steel

Provide factory-applied coating. Clean and phosphate treat exposed surfaces and apply rust-inhibitive primer and baked enamel finish coat, one mil minimum total dry film thickness, color as selected.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Door Louvers

Install louvers in wood doors by using metal "Z" or "L" moldings. Fasten moldings to door with screws.

3.1.3 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.2 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

-- End of Section --

SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A463/A463M	(2010) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C645	(2011) Nonstructural Steel Framing Members
ASTM C754	(2011) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C841	(2003; R 2008e1) Installation of Interior Lathing and Furring
ASTM C847	(2010a) Standard Specification for Metal Lath

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM EMLA 920	(2009) Guide Specifications for Metal Lathing and Furring

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating. Provide support systems and attachments per UFC 3-310-04, "Seismic Design for Buildings" in seismic zones.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, and ASTM C847.

2.1.1.2 Non-loadbearing Wall Framing

NAAMM EMLA 920.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C645.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C645, but not thinner than 0.0179 inch thickness, with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork, equipment and fixtures, 0.0329 inch thickness. The ASTM certified third party testing statement for equivalent thicknesses shall not apply.

2.1.2.3 Furring Structural Steel Columns

ASTM C645. Steel (furring) clips and support angles listed in UL Fire Resistance may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

2.1.2.4 Z-Furring Channels with Wall Insulation

Not lighter than 26 gage galvanized steel, Z-shaped, with 1-1/4 inch and 3/4 inch flanges and depth as required by the insulation thickness provided.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Lath

3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, except as indicated otherwise.

3.1.1.2 Non-loadbearing Wall Framing

NAAMM EMLA 920, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C754, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2.2 Non-loadbearing Wall Framing and Furring

ASTM C754, except as indicated otherwise.

3.1.2.3 Furring Structural Steel Columns

Install studs or galvanized steel clips and support angles for erection of gypsum wallboard around structural steel columns in accordance with the UL Fire Resistance, design number(s) indicated.

3.1.2.4 Z-Furring Channels with Wall Insulation

Install Z-furring channels vertically spaced not more than 24 inches o.c. Locate Z-furring channels at interior and exterior corners in accordance with manufacturer's printed erection instructions. Fasten furring channels to masonry walls with powder-driven fasteners or hardened concrete steel nails through narrow flange of channel. Space fasteners not more than 24 inches o.c.

3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/4 inch in 8 feet from a straight line;

c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/8 inch in 8 feet from a straight line;

c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11	(1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM C1002	(2007) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C1047	(2010a) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
ASTM C1396/C1396M	(2011) Standard Specification for Gypsum Board
ASTM C475/C475M	(2002; R 2007) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C514	(2004; R 2009e1) Standard Specification for Nails for the Application of Gypsum Board
ASTM C840	(2008) Application and Finishing of Gypsum Board
ASTM C954	(2010) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

GYPSUM ASSOCIATION (GA)

GA 214	(2007) Recommended Levels of Gypsum Board Finish
GA 216	(2010) Application and Finishing of Gypsum Panel Products
GA 224	(2008) Installation of Predecorated Gypsum Board
GA 253	(2007) Application of Gypsum Sheathing
GA 600	(2009) Fire Resistance Design Manual

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cementitious backer units

Water-Resistant Gypsum Backing Board

Accessories

Submit for each type of gypsum board and for cementitious backer units.

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.4.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range. Gypsum wallboard shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.4.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Temperature

Maintain a uniform temperature of not less than 50 degrees F in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives.

1.5.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

1.5.3 Temporary Ventilation

Provide temporary ventilation for work of this section.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.7 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of 5 years of documented successful experience.

1.8 SCHEDULING

The gypsum wallboard shall be taped, spackled and primed before the installation of the highly-emitting materials.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.Submit Material Safety Data Sheets and manufacturer maintenance instructionsfor gypsum materials including adhesives.

2.1.1 Gypsum Board

ASTM C1396/C1396M. Gypsum board shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. Paper facings shall contain 100 percent post-consumer recycled paper content. Gypsum cores shall contain a minimum of 95 percent post-industrial recycled gypsum content.See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Gypsum board may contain post-consumer or post-industrial recycled content.

2.1.1.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.1.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2 Gypsum Backing Board

ASTM C1396/C1396M, gypsum backing board shall be used as a base in a multilayer system.

2.1.2.1 Regular

48 inch wide, 5/8 inch thick, square edges.

2.1.3 Regular Water-Resistant Gypsum Backing Board

ASTM C1396/C1396M

2.1.3.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.3.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.4 Cementitious Backer Units

In accordance with the Tile Council of America (TCA) Handbook.

2.1.5 Joint Treatment Materials

ASTM C475/C475M. Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds shall be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

2.1.5.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.5.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.5.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.5.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.5.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.6 Fasteners

2.1.6.1 Nails

ASTM C514.

2.1.6.2 Screws

ASTM C1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

2.1.6.3 Staples

No. 16 USS gageflattened galvanized wire staples with 7/16 inch wide crown outside measurement and divergent point for base ply of two-ply gypsum board application. Use as follows:

Length of Legs	Thickness of Gypsum Board
28.6 mm 1-1/8 inches	12.7 mm 1/2 inch
31.8 mm 1-1/4 inches	15.9 mm 5/8 inch

2.1.7 Adhesives

Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene. Adhesive must meet the requirements of LEED low emitting materials credit.

2.1.7.1 Adhesive for Fastening Gypsum Board to Metal Framing

Not permitted.

2.1.7.2 Adhesive for Laminating

Not permitted. Adhesive attachment is not permitted for multi-layer gypsum boards.

2.1.8 Gypsum Studs

Provide one inch minimum thickness and 6 inch minimum width. Studs may be of one inch thick gypsum board or multilayers fastened to required thickness. Conform to ASTM C1396/C1396M for material.

2.1.9 Accessories

ASTM C1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges shall be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.10 Asphalt Impregnated Building Felt

Provide a 15 lb asphalt moisture barrier over gypsum sheathing. Conforming to ASTM D 226/D 226M Type 1 (No. 15) for asphalt impregnated building felt.

2.1.11 Water

Provide clean, fresh, and potable water.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Gypsum Board and Framing

Verify that surfaces of gypsum board and framing to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.1.3 Masonry Walls

Verify that surfaces of masonry walls to receive gypsum board applied with adhesive are dry, free of dust, oil, form release agents, protrusions and

voids, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C840 or GA 216 and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may not be bonded together with an adhesive. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Minimize framing by floating corners with single studs and drywall clips. Install 5/8 inch gypsum or ceiling board over framing at 24 inches on center. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System I or GA 216.

3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

Apply in accordance with ASTM C840, System II or GA 216.

3.2.3 Adhesive Nail-On Application to Wood Framing

Apply in accordance with ASTM C840, System III or GA 216. This method may be used in lieu of ASTM C840, System I at the option of the Contractor.

3.2.4 Semi-Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System IV or GA 216.

3.2.5 Solid Gypsum Board Partitions

Provide in accordance with ASTM C840, System V or GA 216.

3.2.6 Adhesive Application to Interior Masonry or Concrete Walls

Apply in accordance with ASTM C840, System VI or GA 216.

3.2.7 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C840, System VIII or GA 216.

3.2.8 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C840, System IX or GA 216.

3.2.9 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply glass mat water-resistant gypsum tile backing board or water-resistant gypsum backing board in accordance with ASTM C840, System X or GA 216.

3.2.10 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with ASTM C840, System XI or GA 216.

3.2.11 Glass Mat Covered or Fiber Reinforced Gypsum Sheathing

Apply gypsum sheathing in accordance to gypsum association publications GA 253. Follow gypsum sheathing manufacturer's requirements of design details for joints and fasteners and be properly installed to protect the substrate from moisture intrusion. Do not leave exposed surfaces of the gypsum sheathing beyond the manufacturer's recommendation without a weather barrier cladding. Provide continuous asphalt impregnated building felt over sheathing surface in shingle fashion with edges and ends lapped a minimum of 6 inch. Property flash the openings. Seal all joints, seams, and penetrations with a compatible silicone sealant.

3.2.12 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C840, System XIII or GA 216. Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

3.2.13 Application of Foil-Backed Gypsum Board

Apply foil-backed gypsum board in accordance with ASTM C840, System XIV or GA 216.

3.2.14 Application of Predecorated Gypsum Board

Apply predecorated gypsum board in accordance with GA 224. Attach predecorated gypsum board with adhesive and fasteners as recommended by the manufacturer. Conceal fasteners in the finished work.

3.2.15 Application of Impact Resistant Gypsum Board

Apply in accordance with applicable system of ASTM C840 as specified or GA 216. Follow manufacturers written instructions on how to cut, drill and attach board.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with ANSI A108.11. Place a 15 lb asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 6 inch overlap of sheets laid shingle style.

3.3.2 Joint Treatment

ANSI A108.11.

3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Finish plenum areas above ceilings to Level 1 in accordance with GA 214. Finish water resistant gypsum backing board, ASTM C1396/C1396M, to receive ceramic tile to Level 2 in accordance with GA 214.Finish walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting to Level 3 in accordance with GA 214. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with GA 214.Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall framing in accordance with the specifications contained in UL Fire Resistance for the Design Number(s) indicated, or GA 600 for the File Number(s) indicated. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

-- End of Section --

SECTION 09 30 00

CERAMIC TILE, QUARRY TILE, AND PAVER TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1026	(2010) Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C1027	(2009) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C1028	(2007e1) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C144	(2011) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C206	(2003; R 2009) Standard Specification for Finishing Hydrated Lime
ASTM C207	(2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C241/C241M	(2009) Standard Specification for Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C33/C33M	(2011) Standard Specification for Concrete Aggregates
ASTM C373	(1988; R 2006) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C482	(2002; R 2009) Bond Strength of Ceramic Tile to Portland Cement
ASTM C501	(1984; R 2009) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser

ASTM C648	(2004; R 2009) Breaking Strength of Ceramic Tile
ASTM C847	(2010a) Standard Specification for Metal Lath
ASTM D 2103	(2010) Standard Specification for Polyethylene Film and Sheeting
ASTM D 226/D 226M	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

GREEN SEAL (GS)

GS-36	(2000) Commercial Adhesives

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual	(2003) Dimension Stone Design Manual

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk	(2010) Handbook for Ceramic Tile Installation

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless

otherwise specifically authorized by manufacturer. For materials like Tile, Accessories, and marble Thresholds submit Samples of sufficient size to show color range, pattern, type and joints.

1.2.2 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Tile;
Setting-Bed;
Mortar, Grout, and Adhesive

SD-04 Samples

Tile;
Accessories;
Marble Thresholds;
Grout;

SD-06 Test Reports

Testing;

SD-07 Certificates

Tile;
Mortar, Grout, and Adhesive;

1.4 QUALITY ASSURANCE

Dimension and draw detail drawings at a minimum scale of 1/4 inch = 1 foot. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit drawings showing ceramic tile pattern elevations and floor plans.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 50 degrees F and rising. Maintain temperature above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.

1.8 EXTRA MATERIALS

Supply an extra five percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 TILE

Conform to TCA Hdbk for standard grade tile. Provide grade sealed containers. Mark seals with the marks on the signed master grade certificate. Provide an impact resistant tile with a minimum floor breaking strength for wall tile of 90 pound and for floor tile of 250 pound in accordance with ASTM C648. The manufacturer will provide a frost resistant rating for tile used in cold climate projects as determined by ASTM C1026. Provide a 0.50 maximum percent water absorption in accordance with ASTM C373. Provide a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C1028. Identify floor tile as Class IV Plus-Extra Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C1027 for abrasion resistance as related to foot traffic. Coordinate the color with Finish Specifications. Tile shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content, unless specified otherwise. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Tile may contain post-consumer or post-industrial recycled content. Submit manufacturer's catalog data and preprinted installation and cleaning instructions plus a master grade certificate for tile. Indicate VOC content.

2.1.1 Porcelain Tile

Furnish an unglazed porcelain tile and trim with the color extending uniformly through the body of the tile. Criteria for tile to meet or exceed is as follows: Abrasive wear in accordance with ASTM C501 and bonding strength in accordance with ASTM C482. Comply with 36 CFR 1191 for coefficient of friction for interior tiled floors. Coordinate color with Room Finish Specifications on drawings.

2.1.2 Glazed Wall Tile

Provide glazed wall tile with cushioned edges and trim edged with lead-free matte finish. Provide tile as noted on Finish Specification on drawings.

2.2 SETTING-BED

Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to ASTM C33/C33M for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to ASTM C150/C150M for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to ASTM C144 for sand.

2.2.4 Hydrated Lime

Conform to ASTM C206 for hydrated lime, Type S or ASTM C207, Type S.

2.2.5 Metal Lath

Conform to ASTM C847 for flat expanded type metal lath, and weighing a minimum 2.5 pound/square yard.

2.3 WATER

Provide potable water.

2.4 MORTAR, GROUT, AND ADHESIVE

Submit certificates indicating conformance with specified requirements. Submit LEED documentation relative to low-emitting materials credit in accordance with LEED Reference Guide. Include in LEED Documentation Notebook. Interior adhesives, sealants, primers and sealants used as filler must meet the requirements of LEED low emitting materials credit. Conform to the following for mortar, grout, adhesive, and sealant:

2.4.1 Dry-Set Portland Cement Mortar

TCA Hdbk. Zero-volatile organic compound (VOC) content.

2.4.2 Ceramic Tile Grout

TCA Hdbk; petroleum-free and plastic-free sand portland cement grout. Maximum VOC content of 150 grams/liter.

2.4.3 Organic Adhesive

TCA Hdbk, Type I. Water-resistant. Comply with applicable regulations regarding toxic and hazardous materials, GS-36, and as specified. Tile adhesive shall have a maximum VOC content of 65 grams/liter.

2.4.4 Epoxy Resin Grout

TCA Hdbk. Prohibited unless specifically indicated otherwise.

2.4.5 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Single-component polyurethane sealant shall have a zero-VOC content.

2.4.6 Cementitious Backer Board

Provide cementitious backer units, for use as tile substrate over wood sub-floors, in accordance with TCA Hdbk. Furnish 1/2inch thick cementitious backer units.

2.5 MARBLE THRESHOLDS

Provide marble thresholds of size required by drawings or conditions. Categorize marble Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble with gray in color as approved by the Contracting Officer. Provide minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M.

2.6 MEMBRANE MATERIALS

Conform to ASTM D 226/D 226M, Type 1 for 15 pound waterproofing membrane, asphalt-saturated building felt. Conform to ASTM D 2103 4 mil for polyethylene film.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of TCA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.
Organic Adhesives	3 mm in 2.4 meter1/8 inch in 8 ft.	1.5 mm in 1 meter1/16 inch in 3 ft.
Latex Portland Cement Mortar	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.
Epoxy	3 mm in 2.4 meter1/8 inch in 8 ft.	3.0 mm in 3 meter1/8 inch in 10 ft.

3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for

sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar.

3.3 INSTALLATION OF WALL TILE

Install wall tile in accordance with the TCA Hdbk.

3.3.1 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 4 mil polyethylene membrane, metal lath, and scratch coat. Conform to TCA Hdbk for workable mortar bed, materials, and installation of tile. Conform to TCA Hdbk for cured mortar bed and materials.

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use Latex-Portland Cement to install tile in accordance with TCA Hdbk. Use Latex Portland Cement when installing porcelain ceramic tile.

3.3.3 Organic Adhesive

Conform to TCA Hdbk for the organic adhesive installation of ceramic tile.

3.4 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with TCA Hdbk.

3.4.1 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to TCA Hdbk for workable mortar bed materials and installation. Conform to TCA Hdbk for cured mortar bed materials and installation. Provide minimum 1/4 inch to maximum 3/8 inch joints in uniformed width.

3.4.2 Dry-Set and Latex-Portland Cement

Use Latex-Portland cement mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with TCA Hdbk. Use Latex Portland cement when installing porcelain ceramic tile.

3.4.3 Resinous Grout

When resinous grout is indicated, grout quarry tile with epoxy resin grout. Rake and clean joints to the full depth of the tile and neutralize when recommended by the resin manufacturer. Install epoxy resin grout in conformance with TCA Hdbk. Install resin grout in accordance with manufacturer's printed installation instructions. Provide a coating of wax applied from the manufacturer on all tile installed and furan resin. Follow manufacturer's printed installation instructions of installed resin grout for proportioning, mixing, installing, and curing. Maintain the recommended temperature in the area and on the surface to be grouted. Protect finished grout of grout stain.

3.4.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCA Hdbk.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Install thresholds where indicated, in a manner similar to that of the ceramic tile floor. Provide thresholds full width of the opening. Install head joints at ends not exceeding 1/4 inch in width and grouted full.

3.6 EXPANSION JOINTS

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

3.6.1 Walls

Provide expansion joints at control joints in backing material. Wherever backing material changes, install an expansion joint to separate the different materials.

3.6.2 Floors

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Extend expansion joints through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles.

-- End of Section --

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A489	(2004e1) Standard Specification for Carbon Steel Lifting Eyes
ASTM A580/A580M	(2008) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2007) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635/C635M	(2007) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2010) Latex Sealants
ASTM E 1264	(2008e1) Acoustical Ceiling Products

ASTM E 1414	(2011) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E 1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
ASTM E 580/E 580M	(2011a) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 795	(2005) Mounting Test Specimens During Sound Absorption Tests

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2007; Change 1) Seismic Design for Buildings

1.2 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.2.1 Ceiling Attenuation Class and Test

Provide a ceiling system with an attenuation class (CAC) of 40 - 44 for ACT when determined in accordance with ASTM E 1414. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

1.2.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423 Test Method.

1.2.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings;

SD-03 Product Data

Acoustical Ceiling Systems;

SD-04 Samples

Acoustical Units;
Acoustic Ceiling Tiles;

SD-06 Test Reports

Fire Resistive Ceilings
Ceiling Attenuation Class and Test

1.4 NOT USED

1.5 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.7 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited

to, sagging and warping of panels; rusting and manufacturers defects of grid system.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Submit two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E 1264, Class A, and the following requirements:

2.1.1 Affirmative Procurement

Mineral Wool, Cellulose, and Laminated Paperboard used in acoustic ceiling tiles are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG). EPA's recommended Recovered Materials Content Levels for Mineral Wool, Cellulose, Structural Fiberboard and Laminated Paperboard are:

Product	Material	Percent of Post Consumer Materials	Percent of Total Recovered Materials
Laminate Paperboard	Post Consumer Paper	100	100
Rock Wool	Slag	75	
Cellulose	Post Consumer Paper	75	75

a. The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

2.1.2 Units for Exposed-Grid System A

a. Type: III (non-asbestos mineral fiber with painted finish).

b. Flame Spread: Class A, 25 or less

c. Pattern: A.

d. Minimum NRC: 0.75 in open office areas; 0.60 in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; 0.50 in all other rooms and areas when tested on mounting Type E-400 of ASTM E 795.

e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.

f. Nominal size: 24 by 24 inch.

g. Edge detail: Reveal.

h. Finish: Factory-applied standard finish.

i. Minimum CAC: 40.

2.1.3 Unit Acoustical Absorbers

Absorbers shall be individually mounted sound absorbing plaques composed of glass fibers or non-asbestos mineral fibers and having a NRC range of not less than 0.60 - 0.70 when tested in accordance with ASTM C423 and reported as a 4 frequency average.

2.2 SUSPENSION SYSTEM

Classification	kg/meter (lb/Linear Foot) of Main Runner		
	Direct Hung	Indirect Hung	Furring Bar
Light Duty	7.38 (5.0)	2.95 (2.0)	6.64 (4.5)
Intermediate Duty	17.72 (12.0)	5.17 (3.5)	9.6 (6.5)
Heavy Duty	23.62 (16.0)	11.81 (8.0)	-

Provide standard, exposed-grid, standard width flange as shown on drawings suspension system conforming to ASTM C635/C635M for heavy-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied white baked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide standard or mitered corners. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the guidance in UFC 3-310-04 and ASTM E 580/E 580M.

2.3 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.3.1 Wires

Conform wires to ASTM A641/A641M, Class 1, 0.11 inch in diameter. ASTM A580/A580M, composition 302 or 304, condition annealed stainless steel, 0.11 inch in diameter.

2.3.2 Straps

Provide straps of 1 by 3/16 inch galvanized steel conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008Mwith an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.3.3 Rods

Provide 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

2.3.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Eyebolt size must be a minimum 1/4 inch, zinc coated.

2.3.5 Masonry Anchorage Devices

Comply with ASTM C636/C636M for anchorage devices for eyebolts and machine screws.

2.4 ACCESS PANELS

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 12 by 12 inch or more than 12 by 24 inch.

a. Attach an identification plate of 0.032 inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.

b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 1 inch diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

1 Fire detection/alarm system

2 Air conditioning controls

3 Plumbing system

4 Heating and steam systems

5 Air conditioning duct system

6 Sprinkler system

7 Intercommunication system

11 Program entertainment

12 Telephone junction boxes

2.5 ADHESIVE

Use adhesive as recommended by tile manufacturer.

2.6 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.7 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components as noted on Room Finish Specifications.

2.8 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation.Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

3.4 RECLAMATION PROCEDURES

Neatly stack ceiling tile, designated for recycling by the Contracting Officer, on 4 by 4 foot pallets not higher than 4 foot. Panels must be completely dry. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4078	(2002; R 2008) Water Emulsion Floor Polish
ASTM E 648	(2010e1) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM F 1066	(2004e1; R 2010) Standard Specification for Vinyl Composition Floor Tile
ASTM F 1482	(2004; R 2009e1) Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
ASTM F 1861	(2008) Resilient Wall Base
ASTM F 1869	(2011) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F 2170	(2009) Determining Relative Humidity in Concrete Floor Slabs in situ Probes
ASTM F 710	(2011) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Fire Resistance Requirements

Provide a minimum average critical radiant flux of 0.22 watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E 648.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Flooring and Accessories;

SD-03 Product Data

Resilient Flooring and Accessories;
Adhesives;
Vinyl Composition Tile;
Wall Base;

SD-04 Samples

Resilient Flooring and Accessories;

SD-06 Test Reports

Moisture, Alkalinity and Bond Tests;

SD-08 Manufacturer's Instructions

Surface Preparation;
Installation;

SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories;

1.4 NOT USED

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature maintained

above 68 degrees F and below 85 degrees F, stacked according to manufacturer's recommendations. Remove resilient flooring products from packaging to allow ventilation prior to installation. Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store exposed rubber surface materials in occupied spaces. Do not store near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 68 degrees F and below 85 degrees F for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 55 degrees F thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.7 SCHEDULING

Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 VINYL COMPOSITION TILE TYPE A

Conform to ASTM F 1066 Class 2, (through pattern tile), Composition 1, asbestos-free, 12 inch square and 1/8 inch thick. Provide color and pattern uniformly distributed throughout the thickness of the tile. Tile shall contain a minimum of 90 percent recycled material.

2.2 WALL BASE

Conform to ASTM F 1861, Type TS (vulcanized thermoset rubber), Style B (coved - installed with resilient flooring). Provide 4 inch high and a minimum 1/8 inch thick wall base. Provide job formed corners in matching height, shape, and color. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Rubber sheet flooring may contain post-consumer or post-industrial recycled content.

2.3 MOULDING

Provide tapered mouldings of rubber and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide vertical lip on moulding of maximum 1/4 inch. Provide bevel change in level between 1/4 and 1/2 inch with a slope no greater than 1:2.

2.4 ADHESIVES

Provide adhesives for flooring, base and accessories as recommended by the manufacturer and comply with local indoor air quality standards. Interior adhesives shall meet the requirements of LEED low emitting materials credit. VOC content shall be less than 50 grams/L. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Provide Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

2.5 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers as recommended by the flooring manufacturer for the subfloor conditions. Comply with ASTM F 1482 for panel type underlayment products. Use one of the following substrates:

a. Concrete.

2.6 POLISH/FINISH

Provide polish finish as recommended by the manufacturer and conform to ASTM D 4078 for polish.

2.7 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

2.8 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories selected from manufacturer's standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers. Provide floor patterns as specified on the drawings. Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern. Submit scaled drawings indicating patterns (including location of patterns and colors) and dimensions. Submit manufacturer's descriptive data and three samples of each indicated color and type of flooring, base, mouldings, and accessories sized a minimum 2-1/2 by 4 inch. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 3 EXECUTION

3.1 EXAMINATION

Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation. Do not take any corrective action without written permission from the Government.Work will proceed only when conditions have been corrected and accepted by the installer. Submit manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

3.2 SURFACE PREPARATION

Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor to be flat to within 3/16 inch in 10 feet. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Prepare the surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) as recommended by the flooring manufacturer. Comply with ASTM F 710 for concrete subfloor preparation. Floor fills or toppings may be required as recommended by the flooring manufacturer. Install underlayments, when required by the flooring manufacturer, in accordance with manufacturer's recommended printed installation instructions. Comply with ASTM F 1482 for panel type underlayments. Before any work under this section is begun, correct all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces. Repair all damaged portions of concrete slabs as recommended by the flooring manufacturer. Remove concrete curing and sealer compounds from the slabs, other than the type that does not adversely affect adhesion. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.

3.3 MOISTURE, ALKALINITY AND BOND TESTS

Determine the suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing in accordance with ASTM F 1869 or ASTM F 2170, unless otherwise recommended by the flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Submit copy of test reports for moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

3.4 PLACING VINYL COMPOSITION, LINOLEUM AND SOLID VINYL TILES

Install tile flooring and accessories in accordance with manufacturer's printed installation instructions.Prepare and apply adhesives in accordance with manufacturer's directions. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

3.5 PLACING TRANSITION

Provide transition moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. Secure moulding with adhesive as recommended by the manufacturer. Prepare and apply adhesives in accordance with manufacturer's printed directions.

3.6 PLACING WALL BASE

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

3.7 CLEANING

Immediately upon completion of installation of flooring in a room or an area, dry/clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions. No sooner than 5 days after installation, wash flooring with a nonalkaline cleaning solution, rinse thoroughly with clear cold water, and, except for rubber flooring and stair treads, risers and stringers, vinyl and other flooring not requiring polish finish by manufacturer, apply the number of coats of polish in accordance with manufacturer's written instructions. Clean and maintain all other flooring as recommended by the manufacturer.

3.8 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

SECTION 09 68 00

CARPET

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC TM 107	(2009) Colorfastness to Water
AATCC TM 134	(2006; E 2008) Electrostatic Propensity of Carpets
AATCC TM 16	(2004; E 2008) Colorfastness to Light
AATCC TM 165	(2008; E 2009) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method
AATCC TM 174	(2007) Antimicrobial Activity Assessment of Carpets

ASTM INTERNATIONAL (ASTM)

ASTM D 3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D 5793	(2005) Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
ASTM D 5848	(2010e1) Mass Per Unit Area of Pile Yarn Floor Coverings
ASTM D 6859	(2005) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings
ASTM E 648	(2010e1) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2002) Standard for Installation Specification of Commercial Carpet

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1630	Standard for the Surface Flammability of Carpets and Rugs (FF 1-70)
40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 SYSTEM DESCRIPTION

1.2.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Scheduling

Install carpet systems after the installation and ventilation period of materials or finishes which have high short-term emissions of VOCs, formaldehyde, particulates, or other air-borne compounds which may be adsorbed by or settle on the carpet tiles.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Carpet;
Moldings;
Surface Preparation;
Installation;

SD-04 Samples

Carpet;
Moldings;

SD-06 Test Reports

Moisture and Alkalinity Tests;

SD-10 Operation and Maintenance Data

Carpet;
Cleaning and Protection;
Maintenance Service

1.4 QUALITY ASSURANCE

Provide the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label for carpet and adhesives or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet, carpet cushion, and adhesives bearing the label will indicate that the carpet has been tested and meets the Regulatory Requirements and criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Procure carpet in accordance with 40 CFR 247, and where possible, purchased locally to reduce emissions of fossil fuels from transporting. Conform to EPA requirements in accordance RECYCLED / RECOVERED MATERIALS for carpet.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, and maintain at a temperature above 60 degrees F for 2 days prior to installation. Carpet or carpet tiles shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store carpet near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.6 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above 60 degrees F and below 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten (10) year wear warranty, two (2) year material and workmanship and ten (10) year tuft bind and delamination.

PART 2 PRODUCTS

2.1 CARPET

Furnish first quality carpet; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Provide the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) Label. Carpet type bearing the label will indicate that carpet has been tested and meets the criteria of the CRI Green Label Requirements for Indoor Air Quality Test Criteria. Provide carpet tiles with Carpet Component Identification Codes as established by the CRI for future recycling. The labels shall be permanently printed or attached to the carpet backing. The codes shall identify, at minimum, the carpet's

face fiber, primary backing, and secondary backing. Submit certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.
Submit Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's catalog data for the following items:
Carpet Moldings. Submit samples of the following:

a. Carpet: Two "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

b. Vinyl or Aluminum Moldings: Two pieces of each type at least 12 inches long.

c. Special Treatment Materials: Two samples showing system and installation method.

2.1.1 Modular Tile

Carpet shall comply with the following:

a. Carpet Construction: Tufted or Woven, see Finish Specifications on drawings.

b. Type: Modular tile, see Finish Specifications on drawings for sizes.

c. Pile Type: Multilevel loop.

d. Pile Fiber: Commercial 100 percent branded (federally registered trademark) nylon continuous filament.

e. Yarn Ply: Minimum 2.

f. Gauge or Pitch: Minimum 1/2 inch in accordance with ASTM D 5793.

g. Stitches or Rows/Wires: Minimum 8.0 per square inch.

h. Surface Pile Weight: Minimum 24 ounces per square yard. This does not include weight of backings. Determine weight in accordance with ASTM D 5848.

i. Pile Thickness: Minimum 0.120 inch in accordance with ASTM D 6859.

j. Pile Density: Minimum 4500.

k. Dye Method: Solution dyed.

l. Backing Materials: Provide primary backing materials like synthetic material. Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is needed. Carpet backing may contain post-consumer or post-industrial recycled content.

2.2 PERFORMANCE REQUIREMENTS

a. Static Control: Provide static control to permanently regulate static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC TM 134.

b. Flammability and Critical Radiant Flux Requirements: Comply carpet with 16 CFR 1630. Provide carpet in corridors and exits with a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648.

c. Tuft Bind: Provide tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 10 pound average force for loop pile.

d. Colorfastness to Crocking: Comply dry and wet crocking with AATCC TM 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

e. Colorfastness to Light: Comply colorfastness to light with AATCC TM 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

f. Colorfastness to Water: Comply colorfastness to water with AATCC TM 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

g. Delamination Strength: Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs/inch.

h. Antimicrobial: Nontoxic antimicrobial treatment in accordance with AATCC TM 174 Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.

2.3 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers shall comply with applicable regulations regarding toxic and hazardous materials. Use wet adhesive with a maximum VOC content of 50 grams/liter. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation to meet local air-quality standards, and as required by the carpet manufacturer. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 140 degrees F in accordance with ASTM D 3278.

2.4 MOLDINGS

Install carpet moldings, either vinyl or aluminum, where floor covering material changes or carpet edge does not abut a vertical surface. Provide a hammered surface aluminum molding, pinless clamp-down type, designed for the type of carpet being installed. Provide natural color anodized or heavy-duty vinyl molding designed for the type of carpet being installed.

2.5 TAPE

Provide tape for seams as recommended by the carpet manufacturer for the type of seam used in installation. Any seam sealant shall have a maximum

VOC content of 50 grams/liter. Do not use sealants that contain 1,1,1-trichloroethane or toluene.

2.6 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern in accordance with the drawings.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

3.2 MOISTURE AND ALKALINITY TESTS

Test concrete slab for moisture content and excessive alkalinity in accordance with CRI 104. Submit three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the carpeting until concrete substrate is at least 90 days old. Prepare the concrete surfaces in accordance with instructions of the carpet manufacturer. Match carpet, when required, and adhesives to prevent off-gassing to a type of curing compounds, leveling agents, and concrete sealer.

3.4 INSTALLATION

Isolate area of installation from rest of building. Perform all work by installers who are CFI certified (International Certified Floorcovering Installer Association), or manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI 104. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Use autofoam mothproofing system for wool carpets. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Submit three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

3.4.1 Modular Tile Installation

Install modular tiles with permanent vinyl-compatible or release adhesive and snugly jointed together. Lay tiles as noted on drawings with accessibility to the subfloor where required.

3.4.2 Entrance Carpet Installation

Install tiles with permanent vinyl-compatible or release adhesive and shall be snugly jointed together. Lay tiles as shown on drawings.Prepare regular, unnoticeable, and treated seams with a seam adhesive. Install breadths parallel, with carpet pile in the same direction. Match patterns accurately. Neatly cut and fit, securely, cutouts at door jambs, columns, and ducts. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points.

3.5 CLEANING AND PROTECTION

Submit three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

3.5.1 Cleaning

As specified in Section 01 78 00 CLOSEOUT SUBMITTALS. After installation of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean with a high-efficiency particulate air (HEPA) filtration vacuum.

3.5.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover.Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer. Installation of carpet shall occur when all other trades have completed their work just before substantial completion.

3.6 REMNANTS

Remove non-retained scraps from site and recycle appropriately.

-- End of Section --

SECTION 09 72 00

WALL COVERINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 751	(2006) Coated Fabrics
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)

CFFA-W-101-D	(2002) Vinyl Coated Fabric Wallcovering

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

GYPSUM ASSOCIATION (GA)

GA 214	(2007) Recommended Levels of Gypsum Board Finish

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 286	(2011) Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS CCC-W-408	(Rev D; Notice 1) Wallcovering, Vinyl Coated

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wall Coverings and Accessories;
Primer and Adhesive;
Vinyl Wall Covering;

SD-04 Samples

Wall Coverings and Accessories;
Wall Coverings;

SD-08 Manufacturer's Instructions

Wall Coverings and Accessories

SD-10 Operation and Maintenance Data

Vinyl Wall Covering;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver the material to the site in manufacturer's original wrappings and packages and clearly label with the manufacturer's name, brand name, pattern and color name and number, dye lot number, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than 50 degrees F and within a relative humidity range of 30 to 60 percent. Store wall covering material in a flat position and protected from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

1.5 ENVIRONMENTAL REQUIREMENTS

Comply with wall covering manufacturer's printed installation instructions for minimum temperature of area to receive requirements for conditioning adhesive and wall covering. Provide a minimum 50 degrees F area temperature, 72 hours prior to installation, during installation, and until the adhesive dries. Observe ventilation and safety procedures.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period.

PART 2 PRODUCTS

2.1 WALL COVERINGS

Provide Wall coverings and accessories material designed specifically for the specified use. Furnish vinyl wall covering and borders with a mercury, cadmium, lead, and chromium free base. Protect wall coverings with

bactericides and mildew inhibitors against microbiological and mildew growth.

2.1.1 Vinyl Wall Covering

Provide vinyl wall covering with an integrally pigmented, opaque vinyl film, laminated to, or combined with, a fabric backing and submit manufacturer's catalog data. For wall coverings in general, vinyl wall covering, accessories, primer and adhesive submit/provide the following, as applicable:

a. Wall covering manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

b. Primer and Adhesive manufacturer's descriptive data, documentation stating physical characteristics, mildew and germicidal characteristics. Also Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

c. Three samples of each indicated type, pattern, and color of wall covering. Provide minimum 5 by 7 inch samples of wall covering to show pattern repeat of sufficient size.

d. Vinyl Wall Covering Mockup Panels. After vinyl wall covering samples are approved, and prior to starting installation, provide a minimum 8 by 8 foot vinyl wall covering mock-up for each color and type of vinyl wall covering, using the proposed primers and adhesives and actual substrate materials. Once approved, use the mock-up samples as a standard of workmanship for installation within the facility. Written notification to the Contracting Officer at least 48 hours prior to mock-up installation.

e. Wall Covering: Three samples, 3 yards long by the width specified, of each color and grain to be installed in the work, as required to illustrate material weight, color, shade, decorative design, and embossing when required.

f. Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. Date the statement after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified. Certificates for Vinyl Wall Covering including the following:

   (1) Certified laboratory test reports of the physical properties for vinyl wall covering, as specified.

   (2) Certificates of Compliance for UL fire hazard classification listing, as specified.

   (3) Certificates of Compliance for contact adhesive.

g. Preprinted installation instructions for wall covering and accessories, adhesives and primers. Include preparation of the substrate within the instructions.

h. Preventative maintenance and inspection for Vinyl Wall Covering showing the manufacturer's recommended cleaning materials and application methods, including precautions in the use of cleaning materials that may be detrimental to the wall covering surface when improperly applied.

Provide a medium-duty type wall covering, finish as specified, conforming to FS CCC-W-408, Type II, and the following modifications:

Supporting material for wall covering may be mildew-resistant treated at the option of the wall covering manufacturer.

Provide the following physical properties:

REQUIREMENT	TEST METHOD	VALUE
Coating weight, exclusive of fabric backing	CFFA-W-101-D, Test 5041	Not less than 240 gm per square meter 7 ounces per square yard
Adhesion of coating to fabric backing	ASTM D 751	Not less that 13 N 3 pounds pull per 25 mm inch of width

Match color and grain of wall covering of the sample approved. Provide a 53 to 54 inch width wall covering.

2.1.2 Vinyl Wall covering Type A

	Type I	Type II	Type III
ozs/sq yd	7 (10)	13	
ozs/linear yd	10.5 (15)	20	
g/sq meter	237 (339)	441	
g/linear meter	325 (465)	620	

Provide a vinyl coated woven or nonwoven wall covering fabric. Conform to CFFA-W-101-D for vinyl wall covering, Type II (Medium Duty) with a minimum total weight of 13 ounces/square yard and 20 ounces/linear yard. Provide width of 52/54 inch. Test vinyl wall covering in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E 84.

2.2 PRIMER AND ADHESIVE

Provide a type primer and adhesive recommended by the wall covering manufacturer, containing a non-mercury based mildewcide, and complying with local indoor air quality standards. VOC content shall be less than the current VOC content limits of SCAQMD Rule 1168. Primer shall permit removal of the wall covering and protect the wall surface during removal. Do not damage gypsum wallboard facing paper during removal of wall covering. Provide a strippable type adhesive. When substrate color variations show through vinyl wall covering, provide a white pigmented primer as recommended

by the wall covering manufacturer used to conceal the variations. Provide a recommended type adhesive to install corner guards and wainscot cap by the manufacturer of the corner guards and wainscot cap.

2.3 COLOR, TEXTURE, AND PATTERN

Provide color as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 EXAMINATION

Inspect all areas and conditions under which wall coverings are to be installed. Notify the Contracting Officer, in writing, of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Do not apply wall covering to surfaces that are rough, that contain stains which will bleed through the wall covering, or that are otherwise unsuitable for proper installation. Fill cracks and holes; sand rough spots smooth. Finish walls to receive presentation dry erase wall covering to a Level 4 gypsum wallboard finish in accordance with GA 214 unless Level 5 is recommended by the wall covering manufacturer. Thoroughly dry surfaces at least 30 days prior to installation of vinyl wall covering. Provide interior surfaces of new and existing gypsum wallboard with a wall covering primer in accordance with the manufacturer's printed instructions. As required, use white primer when substrate color variations are visible through thin or light color wall covering. Seal interior surfaces of exterior masonry walls to prevent moisture penetration, then prime with a wall covering primer in accordance with the manufacturer's printed instructions. Provide masonry walls with flush joints. Test moisture content of plaster, concrete, and masonry with an electric moisture meter of a maximum five percent reading. Apply a thin coat of joint compound or cement plaster, as recommended by the wall covering manufacturer, to the concrete and masonry walls as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, prime the walls as recommended by the wall lining manufacturer. Prime the surfaces of walls as required by the manufacturer's printed instructions to permit ultimate removal of wall covering from the wall surfaces. Allow primer to completely dry before adhesive application.

3.3 INSTALLATION

3.3.1 Corner Guards and Wainscot Cap

Install corner guards and wainscot cap where shown on drawings and in accordance with the manufacturer's printed instructions. Run corner guards from top of base to ceiling in a continuous length.

3.4 CLEAN-UP

Upon completion of the work, clean wall covering free of dirt, soiling, stain, or residual film. Remove and clean surplus materials, rubbish, and debris resulting from the wall covering installation.

-- End of Section --

SECTION 09 83 13

ACOUSTICAL WALL TREATMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2009; Errata First Printing) International Building Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings;

SD-03 Product Data

Installation Acoustical Wall Panels;

SD-04 Samples

Acoustical Wall Panels;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Protect materials delivered and placed in storage from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 ACOUSTICAL WALL PANELS

Provide acoustical wall panels consisting of prefinished, factory assembled, seamless fabric covered, fiber glass or mineral fiber core system as described below manufactured to the dimensions and configurations shown on the approved detail drawings; submit drawings showing plan locations, elevations and details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials. Perimeter edges shall be reinforced by either an aluminum frame or a formulated resin edge hardener. Acoustical wall panels installed in non-sprinklered areas shall comply with the requirements of ICC IBC, Standard 42-2. Comply with EPA requirements in accordance with RECYCLED / RECOVERED MATERIALS. Submit manufacturer's descriptive data and catalog cuts; wood system with backing, minimum 18 inches wide by 24 inches long 3 samples of each color range specified; and certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance. Wall panels shall conform to the following:

a. Panel Width: Widths shall be nominal 48 inches Panel width shall be as detailed.

b. Panel Height: Heights shall be nominal 24 inches. Panels shall be field measured for custom fit to ceiling.

c. Thickness: Panel thickness shall be as required to meet the indicated NRC range; 3 and 1/8 inch.

d. Panel Construction: Seamless clear lacquer solid bentwood birch profiles, a lacquered solid wood frame and an acoustically rated polyester fiber batting with an anthracite-colored linen cover. Fabric covering shall be stretched free of wrinkles and then bonded to the edges and back or bonded directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer.

e. Fire rating for the complete composite system: Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E 84.

f. Noise Reduction Coefficient (NRC) Range: 0.80-0.90 ASTM C423.

g. Core Type: Acoustically rated polyester finer batting core.

h. Mounting: Acoustical panels shall be mounted by manufacturer's standard keyholes. Provide blocking in wall at all keyhole mounting sites. Install panels per manufacturer instructions. Coordinate keyhole locations to mount directly to studs. Panels to be installed horizontally.

2.2 COLOR

Color shall be as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Walls shall be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Do not begin installation until all wet work, such as, plastering, painting, and concrete are completely dry.

3.2 INSTALLATION

Panel installation shall be by personnel familiar with and normally engaged in installation of acoustical wall panels. Apply panels in accordance with the manufacturer's installation instructions. Submit manufacturer's installation instructions and recommended cleaning instructions.

3.3 CLEANING

Following installation, dirty or stained panel surfaces shall be cleaned in accordance with manufacturer's instructions and left free from defects. Panels that are damaged, discolored, or improperly installed shall be removed and new panels provided as directed.

-- End of Section --

SECTION 09 84 39

ACOUSTICAL CEILING CLOUDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.

Other related sections include Section 09 51 00 ACOUSTICAL CEILINGS, Section 09 29 00 GYPSUM BOARD, Division 23 HVAC and Division 26 ELECTRICAL.

1.2 SUMMARY

This section includes acoustical clouds, attachment hangers and fasteners.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(2009c) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2010) Standard for the Installation of Sprinkler Systems

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

Layout and details of acoustical clouds. Show locations of items which are to be coordinated with acoustical clouds.

SD-03 Product Data

Acoustical Cloud Unit;

Submit manufacturer's technical data for each type of cloud system required.

SD-08 Manufacturer's Instructions

Installation instructions;

1.5 QUALITY ASSURANCE

1.5.1 Single Source Responsibility

Provide acoustical clouds and method of attachment by a single manufacturer.

1.5.2 Coordination of Work

Coordinate acoustical cloud work with installers of related work including, but not limited to suspended ceilings, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.5.3 Seismic Performance

The International Building Code allows architectural components to swing freely as long as they will not be damaged or cause damage. Soundscapes Shapes Acoustical Clouds suspended individually with aircraft cable will swing no more than 18 inches in any direction for each panel. Shapes direct attached to drywall or suspended in group systems have been engineered for application in all seismic areas.

1.5.4 Acoustical Clouds

Acoustical clouds, as with other architectural features located in the ceiling plane, may obstruct or skew the existing or planned fire sprinkler water distribution pattern, or possibly delay the activation of the fire sprinkler or fire detection system. Designers and installers are advised to consult a fire protection engineer, NFPA 13, and their local codes for guidance on the proper installation techniques where fire detection or suppression systems are present.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver acoustical clouds to project site in original, unopened packages and store them in a fully enclosed space between 40 degrees F and 120 degrees F where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes. All wet work (plastering, concrete, etc) must be complete and dry. Before installing acoustical clouds, permit them to reach room temperature and a stabilized moisture content. Handle acoustical clouds carefully to avoid damaging the surface and edges in any way.

1.7 PROJECT CONDITIONS

1.7.1 Space Enclosure

Building areas to receive acoustical clouds shall be free of construction dust and debris. Products can be installed in temperatures between 40

degrees F and 120 degrees F. Cannot be used in exterior applications, where standing water is present, or where moisture will come in direct contact with the acoustical cloud.

1.8 WARRANTY

1.8.1 Acoustical Clouds

Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical clouds that fail within the warranty period. Failures include, but are not limited to:

a. Acoustical clouds: Manufacturing defects or chipped or broken tiles.

b. Attachment devices: Rusting and manufacturing defects.

1.8.2 Warranty Period

Warranty Period shall be as follows:

a. Acoustical Clouds: One (1) year from date of substantial completion.

b. Attachment devices: One (1) year from date of substantial completion.

The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.1 ACOUSTICAL CLOUD UNITS

a. Surface Texture: See specifications on drawings.

b. Composition: See specifications on drawings.

c. Surface finish: See specifications on drawings.

d. Color: White

e. Shapes: Circle, see specifications on drawings and reflected ceiling plan.

f. Thickness: 7/8 inch

g. Flame Spread: ASTM E 84, Class A

h. Light Reflectance: (LR): ASTM E 1477, White: 0.90

i. Acoustical Absorption: ASTM C 423, White: Minimum 1.17 Sabins/sf

j. Recycle Content: Minimum 35 percent

k. Antimicrobial protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

2.2 ATTACHMENT SYSTEMS

Installation Hardware Kits for (individual suspension).

a. Deck Hanging Kit

b. Extended Hanging Cables

PART 3 EXECUTION

3.1 PREPARATION

Measure each ceiling area and establish layout of acoustical clouds and installation hardware. Comply with reflected ceiling plans. Coordinate panel layout with mechanical, electrical and sprinkler fixtures.

3.2 INSTALLATION

Install panels in accordance with the manufacturer's installation instructions, LA-297302, and in compliance with the authorities having jurisdiction.

3.3 ADJUSTING AND CLEANING

Replace damaged and broken tiles. Clean exposed surfaces of acoustical clouds per manufacturer's instructions.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100Doc	(2005) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 235	(2002; R 2007) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4263	(1983; R 2005) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4444	(2008) Use and Calibration of Hand-Held Moisture Meters
ASTM D 523	(2008) Standard Test Method for Specular Gloss
ASTM D 6386	(2010) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM F 1869	(2011) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

MASTER PAINTERS INSTITUTE (MPI)

MPI 107	(Oct 2009) Rust Inhibitive Primer (Water-Based)

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP-01	(2000) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Guide 6	(2004) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC Guide 7	(2004; E 2004) Guide to the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel
SSPC PA Guide 3	(1982; E 1995) A Guide to Safety in Paint Application
SSPC QP 1	(1998; E 2004) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
SSPC SP 1	(1982; E 2004) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP 12/NACE No.5	(2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SSPC SP 2	(1982; E 2004) Hand Tool Cleaning
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC VIS 1	(2002; e 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-680	(2010; Rev C) Degreasing Solvent

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(Rev D; Am 1) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1001	Asbestos
29 CFR 1910.1025	Lead
29 CFR 1926.62	Lead

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

SD-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Certification

Environmental Data

Materials;

Coating;

Manufacturer's Technical Data Sheets;

Indicate VOC content.

Sealant

SD-04 Samples

Color;

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

Qualification Testing laboratory for coatings;

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings:

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.3.2 SSPC QP 1 Certification

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

1.4 NOT USED

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.4 Asbestos Content

Materials shall not contain asbestos.

1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.5.7 Human Carcinogens

Materials shall not contain ACGIH 0100Doc and ACGIH 0100Doc confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN.

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA Guide 3.

1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.

b. 29 CFR 1910.1000.

c. ACGIH 0100Doc, threshold limit values.

d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

e. The appropriate OSHA standards in 29 CFR 1910.1001 for surface preparation of painted surfaces containing asbestos. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

1.8 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. Isolate area of application from rest of building when applying high-emission paints or coatings.

1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Less than 5 degrees F above dew point;

b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.8.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.9 NOT USED

1.10 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs.

1.11 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be as indicated in the Finish Schedule specifications on drawings.

1.12 LOCATION AND SURFACE TYPE TO BE PAINTED

1.12.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.12.1.1 Exterior Painting

Includes new surfaces, existing coated surfaces, of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.12.1.2 Interior Painting

Includes new surfaces, existing uncoated surfaces, and existing coated surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.12.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

1.12.3 Mechanical and Electrical Painting

Includes field coating of interior new and existing surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation

(2) New aluminum jacket on piping

(3) New interior ferrous piping under insulation.

1.12.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material. In lieu of red enamel finish coat, provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals.

b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a

minimum dry film thickness of 1.0 mil. Provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals throughout the piping systems.

1.12.4 Definitions and Abbreviations

1.12.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.12.4.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

1.12.4.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.12.4.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.12.4.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.12.4.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.12.4.7 EXT

MPI short term designation for an exterior coating system.

1.12.4.8 INT

MPI short term designation for an interior coating system.

1.12.4.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.12.4.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.12.4.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.12.4.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.12.4.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.12.4.14 Paint

See Coating definition.

1.12.4.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.12.4.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 RESEALING OF EXISTING EXTERIOR JOINTS

3.2.1 Surface Condition

Surfaces shall be clean, dry to the touch, and free from frost and moisture; remove grease, oil, wax, lacquer, paint, defective backstop, or other foreign matter that would prevent or impair adhesion. Where adequate grooves have not been provided, clean out to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to adjoining work. Grinding shall not be required on metal surfaces.

3.2.2 Backstops

In joints more than 1/2 inch deep, install glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free of oil or other staining elements as recommended by sealant manufacturer. Backstop material shall be compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

3.2.3 Primer and Bond Breaker

Install the type recommended by the sealant manufacturer.

3.2.4 Ambient Temperature

Between 38 degrees F and 95 degrees F when applying sealant.

3.2.5 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Color(s) shall be selected by the Contracting Officer. Apply the sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Sealant shall be uniformly smooth and free of wrinkles.

3.2.6 Cleaning

Immediately remove fresh sealant from adjacent areas using a solvent recommended by the sealant manufacturer. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean condition. Allow sealant time to cure, in accordance with manufacturer's recommendations, prior to coating.

3.3 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.

b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D 235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.

c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.

d. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer.

e. Previously painted surfaces specified to be repainted or damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.

f. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.

g. Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8.

h. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.

i. Edges of chipped paint shall be feather edged and sanded smooth.

j. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.

k. New, proposed coatings shall be compatible with existing coatings.

3.3.2 Existing Coated Surfaces with Minor Defects

Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings. Remove chalking by sanding so that when tested in accordance with ASTM D 4214, the chalk rating is not less than 8.

3.3.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

a. Surfaces containing large areas of minor defects;

b. Surfaces containing more than 20 percent peeling area; and

c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

3.3.4 Substrate Repair

a. Repair substrate surface damaged during coating removal;

b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and

c. Clean and prime the substrate as specified.

3.4 PREPARATION OF METAL SURFACES

3.4.1 Existing and New Ferrous Surfaces

Ferrous Surface Preparation
SSPC Blasting/Cleaning Levelsa - Primer Types/Exposures

	Exposureb		
	Mild	Moderate	Severec
Primer Type	alkyd/oil latex oleoresinous phenolic	alkyd/oil latex oleoresinous phenolic	epoxy silicone inorganic zinc-rich
Surface Condition			
Uncoated			
Oil, grease, dirt	SP 1	for all moderate conditions, select from "mild" or "severe" for intended performance level	SP 10, SP 12 WJ2 or SP 5, SP 12 WJ1
Localized corrosion - mill scale, rust	SP 2, SP 3, or SP 7, SP 12 WJ-4		AS ABOVE
Extensive deterioration	SP 6d, SP 12 WJ-3		AS ABOVE
Shop coated			
Oil, grease, dirt	e		AS ABOVE
Localized damange to be spot repaired	SP 2, SP 3, or SP 7, SP 12 WJ-4		AS ABOVE
Extensive deterioration	SP 6d, SP 12 WJ-3		AS ABOVE

Existing coating			
Oil, grease	e	e	SP 1
Chalking, foreign matter other than oil or greese, localized deterioration	f		g
Extensive deterioration	SP 6d, SP 12 WJ-3		SP 10, SP 12 WJ2 or SP 5, SP 12 WJ1

a If it is not possible to abrasive blast or use water jetting, SP 11 is recommended. It is considered equivalent to SP 6. SP 11 is also preferred wherever SP 2 or SP 3 are shown in the Table.

b These are minimum requirements. A high-performing system may be a better choice forlonger performance.

c For marine, chemical, or immersion service, or application of heat resistant or nonslip floor coatings. SP 10 is preferred for zinc-rich primers, and for extremely severe environments where long-term performance is desired.

d Use water jetting to SP 12 WJ-3, as alternate to SP 6 degree ofcleanliness.

e Use only the steam clean, or non-alkaline detergent solutions of SP 1.

f First, remove chalk and dirt with a non-alkaline detergent solution, and follow with power wash at minimum 2000 psi. Second, spot clean, in order of preference by SP 6, SP 11, SP 7, SP 3, or SP2.

g First, remove chalk and dirt with a non-alkaline detergent solution, and follow with power wash at minimum 2000 psi. Second, spot clean, in order of preference, by SP 10, SP 6, or SP 11.

h SSPC SP 12/NACE No.5 provides four levels of water jetting cleanliness and they reflect thefour levels of abrasive blast cleanliness but direct correlation is inaccurate or inappropriate. Thefour levels are (best to worst): WJ-1, WJ-2, WJ-3, and WJ-4. They are equivalent to the abrasive blast standards SSPC SP 5, SP 10, SP 6, and SP 7. The standard also includes three levels of cleanliness for nonvisual contaminants, SC-1, SC-2, and SC-3. The preferred level of cleanliness is between SC-1or SC-2.

a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2. Brush-off blast remaining surface in accordance with SSPC SP 7/NACE No.4; Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/NACE No.3/SSPC SP 12/NACE No.5 WJ-3.

3.4.2 Final Ferrous Surface Condition:

Type Coating	Level of Cleaning, SSPC SP ...
a. Latex or Alkyd	2,3,6 or SP 12 WJ-2. (7 and 10, SP 12 WJ-2 or SP 12 WJ-1 may be left in as Contractor options)
b. High Performance (i.e. Epoxy, Urethane, others)	7,10

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

3.4.3 Galvanized Surfaces

a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 6386, Appendix X2, and remove by one of the methods described therein.

b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12/NACE No.5 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Spot abrasive blast rusted areas as described for steel in SSPC SP 6/NACE No.3, and waterjet to SSPC SP 12/NACE No.5, WJ3 to remove existing coating.

3.4.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.4.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D 235. Wipe dry with clean, dry cloths.

3.4.6 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water.

3.5 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.5.1 Concrete and Masonry

a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.

b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil:Wash new and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. Wash existing coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new , existing coated, and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.

c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet

in 24 hours as determined by ASTM F 1869. In all cases follow manufacturer's recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.5.2 Gypsum Board, Plaster, and Stucco

a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.

b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5.3 Existing Asbestos Cement Surfaces

Remove oily stains by solvent cleaning with mineral spirits, MIL-PRF-680. Remove loose dirt, dust, and other deleterious substances by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material. Do not wire brush or clean using other abrasive methods. Surfaces shall be dry and clean prior to application of the coating.

3.6 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.6.1 New Plywood and Wood Surfaces, Except Floors:

a. Wood surfaces shall be cleaned of foreign matter.

Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.

b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, 1 ounce (1/3 cup) household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

c. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D 4444, Method A, unless otherwise authorized.

d. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.

e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.

f. Cosmetic Repair of Minor Defects:

(1) Knots and Resinous Wood and Fire, Smoke, Water, and Color Marker Stained Existing Coated Surface: Prior to application of coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

3.7 APPLICATION

3.7.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while

painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 1.0 mil. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

e. Floors: For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.

3.7.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.7.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.7.4 Coating Systems

a. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.

b. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

c. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

   (1) One coat of primer.

   (2) One coat of undercoat or intermediate coat.

   (3) One topcoat to match adjacent surfaces.

d. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.8 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.9 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

3.10 COATING SYSTEMS FOR WOOD AND PLYWOOD

a. Apply coatings of Tables in Division 6 for Exterior and Interior.

b. Prior to erection, apply two coats of specified primer to treat and prime wood and plywood surfaces which will be inaccessible after erection.

c. Apply stains in accordance with manufacturer's printed instructions.

3.11 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with ASME A13.1. Place stenciling in clearly visible locations. On piping not covered by ASME A13.1, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.12 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.13 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers.

-- End of Section --

SECTION 10 14 02

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2004) Safety Glazing Materials Used in Buildings

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Installation;

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Samples

Interior Signage;

One sample of each of the following sign types showing typical quality, workmanship and color. The samples may be installed in the work, provided each sample is identified and location recorded.

a. Directional sign.

b. Standard Room sign.

1.3 GENERAL

Interior signage shall be of the design, detail, sizes, types, and message content shown on the drawings/attachments/signage placement schedule (as applicable), shall conform to the requirements specified, and shall be

provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Signage shall be obtained from a single manufacturer with edges and corners of finished letterforms and graphics true and clean.

1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials shall be packaged to prevent damage and deterioration during shipment, handling, storage and installation. Product shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

2.1.1 Standard Room Signs

Signs shall consist of acrylic plastic 0.080 inch thickness minimum conforming to ANSI Z97.1 and shall conform to the following:

Units shall be frameless. Corners of signs shall be rounded to as indicated.

2.1.2 Type of Mounting For Signs

Extruded aluminum brackets shall be furnished for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners. Surface mounted signs shall be mounted with 1/16 inch thick vinyl foam tape fabricated from materials that are not corrosive to sign material and mounting surface.

2.1.3 Graphics

Signage graphics for modular signs shall conform to the following:

Subsurface copy: Copy is transferred to the back face of clear acrylic sheeting forming the panel face to produce precisely formed opaque image. This method bonds all sign elements (color, graphics, lettering, braille and substrate) into a single unit.

2.1.4 Character Proportions and Heights

Letters and numbers on indicated signs which do not designate permanent rooms or spaces shall be as indicated on the drawings.

2.1.5 Raised and Brailled Characters and Pictorial Symbol Signs (Pictograms)

Raised and brailled characters and symbols are only required on signs that designate permanent rooms or spaces, including restrooms and room numbers.

They are not required for information or way-finding signs. Raised letters and numbers on signs must protrude 1/32 inch upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch in height, but no higher than 2 inches. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 6 inches minimum in height. Indicated accessible facilities shall use the international symbol of accessibility.

2.2 INDIVIDUAL CUT PLASTIC LETTERS

2.2.1 Fabrication

Letters shall be fabricated from laser cut or waterjet acrylic. Letters shall be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters shall be packaged for protection until installation.

2.2.2 Typefaces, Thicknesses, Colors and Sizes

Typefaces, thicknesses, colors and sizes are indicated on signage schedule, Sheet A-181.

2.2.3 Mounting

Letters shall be surface mounted to painted surfaces with double sided adhesive tape. Templates for mounting shall be supplied.

2.3 FABRICATION AND MANUFACTURE

2.3.1 Factory Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.4 COLOR, FINISH, AND CONTRAST

Color shall be as indicated on the drawings. Finish of all signs shall be eggshell, matte, or other non-glare finish as required in handicapped-accessible buildings.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed plumb and true and in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Distance from edge of door frame to edge of sign shall be as indicated on drawings. Required blocking shall be installed. Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until

finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

3.1.1 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Sign surfaces shall be cleaned at completion of sign installation in accordance with the manufacturer's approved instructions.

-- End of Section --

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A385/A385M	(2009) Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM D 1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products

INTERNATIONAL CODE COUNCIL (ICC)

ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60003	(Basic) Partitions, Toilet, Complete

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

1.2 SYSTEM DESCRIPTION

Provide a complete and usable toilet partition system, including toilet enclosures, room entrance screens, urinal screens, system of panels, hardware, and support components. Furnish the partition system from a single manufacturer, with a standard product as shown in the most recent catalog data. Submit Fabrication Drawings for metal toilet partitions and urinal screens consisting of fabrication and assembly details to be performed in the factory. Submit manufacturer's Cleaning and Maintenance Instructions with Fabrication Drawings for review.

1.2.1 Sustainable Design Requirements

1.2.1.1 Local/Regional Materials Documentation

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.2.2 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D 1972. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual.

a. Type 2: High Density Polyethylene (HDPE).

b. Type 3: Vinyl (Polyvinyl Chloride or PVC).

c. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings
Installation Drawings;

SD-03 Product Data

Cleaning and Maintenance Instructions
Colors And Finishes;
Anchoring Devices and Fasteners
Hardware and Fittings
Brackets Door
Hardware

SD-04 Samples

Colors and Finishes;
Hardware and Fittings
Anchoring Devices and Fasteners

SD-07 Certificates

Warranty

1.4 REGULATORY REQUIREMENTS

Conform to ICC/ANSI A117.1 code for access for the handicapped operation of toilet compartment door and hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the manufacturer's original unopened packages with the brand, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated; free from dust, water, other contaminants, and damage during delivery, storage, and construction.

1.6 WARRANTY

Provide certification or warranties that metal toilet partitions will be free of defects in materials, fabrication, finish, and installation and will remain so for a period of not less than 5 years after completion.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Anchoring Devices and Fasteners

Provide steel anchoring devices and fasteners hot-dipped galvanized after fabrication, in conformance with ASTM A385/A385M and ASTM A123/A123M. Conceal all galvanized anchoring devices.

2.1.2 Brackets

Wall brackets shall be two-ear panel brackets, T-style, 1-inch stock. Provide stirrup style panel-to-pilaster brackets.

2.1.3 Hardware and Fittings

2.1.3.1 General Requirements

Conform hardware for the toilet partition system to CID A-A-60003 for the specified type and style of partitions. Provide hardware finish highly resistant to alkalis, urine, and other common toilet room acids. Comply latching devices and hinges for handicap compartments with 36 CFR 1191; provide stainless steel devices and hinges with door latches that operate without either tight grasping or twisting of the wrist of the operator. Submit three samples of each item, including anchoring devices and fasteners. Approved hardware samples may be installed in the work if properly identified.

a. Corrosion-resistant steel shall conform to ASTM A167, Type 304.

2.1.3.2 Finishes

a. Aluminum shall have a clear anodic coating conforming to AA DAF45.

b. Corrosion-resistant steel shall have a No. 4 finish.

c. Exposed fasteners shall match the hardware and fittings.

2.1.4 Door Hardware

2.1.4.1 Hinges

Hinges shall be adjustable to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors to 10 degrees. Provide self-lubricating hinges with the indicated swing. Hinges shall be the surface-mounted type and have the following type of return movement:

a. Gravity return movement

2.1.4.2 Latch and Pull

Latch and pull shall be a combination rubber-faced door strike and keeper equipped with emergency access.

2.1.4.3 Coat Hooks

Coat hooks shall be combination units with hooks and rubber tipped pins.

2.2 PARTITION PANELS AND DOORS

Fabricate partition panels and doors not less than 1 inch thick.

2.2.1 Toilet Enclosures

Conform toilet enclosures to CID A-A-60003, Type I, Style A, floor supported, C, overhead braced. Furnish width, length, and height of toilet enclosures as shown. Provide a width of 1 inch. Finish surface of panels shall be solid phenolic, Finish 4; water resistant; graffiti resistant; non-absorbent. Enclosures shall contain a minimum of 20 percent post-consumer recycled plastic. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. This item may contain post-consumer or post-industrial recycled content. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required. Provide grab bars to withstand a bending stress, shear stress, shear force, and a tensile force induced by 250 lbf. Grab bars shall not rotate within their fittings.

2.2.2 Urinal Screens

Conform urinal screens to CID A-A-60003, Type III, Style A, floor supported, C, overhead braced. Provide finish for surface of screens as solid phenolic, Finish 4; water resistant; graffiti resistant; non-absorbent. Screens shall contain a minimum of 20 percent post-consumer recycled plastic. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements.This item may contain post-consumer or post-industrial recycled content. Furnish width and height of urinal screens as shown. Provide thickness of 1 inch. Secure wall hung urinal screens with a minimum of three wall stirrup brackets. Fabricate screens from the same types of panels and pilasters as the toilet partitions. Use corrosion-resistant steel fittings and fasteners. Include in LEED Documentation Notebook.

2.3 FLOOR-ANCHORED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0635 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a steel bar not less than 1/2 by 7/8 inch welded to the reinforced face sheets and having not less than two 3/8 inch round anchorage devices for securing to the floor slab. Provide anchorage devices complete with threaded rods, expansion shields, lock washers, and leveling-adjustment nuts. Trim piece at the floor shall be 3 inch high and fabricated from not less than 0.030 inch thick corrosion-resistant steel.

2.4 OVERHEAD-BRACED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0393 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a channel-shaped floor stirrup fabricated from not less than 0.0635 inch thick material and a leveling bolt. Secure the stirrup to the pilaster with not less than a 3/16 inch bolt and nut after the pilaster is leveled. Secure the stirrup to the floor with not less than two lead expansion shields and sheetmetal screws. Fabricate overhead brace from a continuous extruded aluminum tube not less than 1 inch wide by 1-1/2 inch high, 0.125-inch wall thickness. Finish shall be AA-C22A31 in accordance with AA DAF45. Set and secure brace into the top of each pilaster. Fabricate 3 inch high trim piece at the floor from not less than 0.030 inch thick corrosion-resistant steel.

2.5 PILASTER SHOES

Provide shoes at pilasters to conceal floor-mounted anchorage. Pilaster shoes shall be stainless steel. Shoes shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. See Section 01 33 29 LEED(tm) DOCUMENTATION for cumulative total recycled content requirements. Pilaster shoes may contain post-consumer or post-industrial recycled content. Height shall be 3 inches.

2.6 HARDWARE

Hardware for the toilet partition system shall conform to CID A-A-60003 for the specified type and style of partitions. Hardware shall be pre-drilled by manufacturer. Hardware finish shall be highly resistant to alkalis, urine, and other common toilet room acids. Latching devices and hinges for handicap compartments shall comply with 36 CFR 1191 and shall be stainless steel door latches that operate without either tight grasping or twisting of the wrist of the operator. Screws and bolts shall be stainless steel, tamper proof type.Wall mounting brackets shall be continuous, full height, stainless steel, in accordance with toilet compartment manufacturer's instructions. Floor-mounted anchorage shall consist of corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor.

2.7 COLORS AND FINISHES

2.7.1 Colors

Provide manufacturer's standard color charts for color of finishes for toilet partition system components. Submit three samples showing a finished

edge on two adjacent sides and core construction, each not less than 12-inch square

2.7.2 Finishes No.4

Provide solid plastic fabricated of solid phenolic core with melamine facing sheets formed under high pressure rendering a single component section not less than one inch thick. Colors shall extend throughout the panel thickness. Provide exposed finish surfaces: smooth, waterproof, non-absorbent, and resistant to staining and marking with pens, pencils, or other writing devices. Solid plastic partitions shall not show any sign of deterioration when immersed in the following chemicals and maintained at a temperature of 80 degrees F for a minimum of 30 days:

a. Acetic Acid (80 percent)	Hydrochloric Acid (40 percent)
b. Acetone	Hydrogen Peroxide (30 percent)
c. Ammonia (liquid)	Isopropyl Alcohol
d. Ammonia Phosphate	Lactic Acid (25 percent)
e. Bleach (12 percent)	Lime Sulfur
f. Borax	Nicotine
g. Brine	Potassium Bromide
h. Caustic Soda	Soaps
i. Chlorine Water	Sodium Bicarbonate
j. Citric Acid	Trisodium Phosphate
k. Copper Chloride	Urea; Urine
l. Core Oils	Vinegar

PART 3 EXECUTION

3.1 PREPARATION

Take field measurements prior to the preparation of drawing and fabrication to ensure proper fits. Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work. Verify correct spacing of plumbing fixtures. Verify correct location of built in framing, anchorage, and bracing. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install partitions rigid, straight, plumb, and level, with the panels centered between the fixtures. Provide a panel clearance of not more than 1/2 inch and secure the panels to walls and pilasters with not less than two wall brackets attached near the top and bottom of the panel. Locate wall brackets so that holes for wall bolts occur in masonry or tile joints. Secure Panels to pilasters with brackets matching the wall brackets. Provide for adjustment due to minor floor variations. Locate head rail joints at pilaster center lines. Install adjacent components for consistency of line and plane. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors.

a. Secure panels to hollow plastered walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

b. Secure panels to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

c. Secure panels to solid masonry or concrete with lead or brass expansion shields designed for use with not less than 1/4-20 screws, with a shield length of not less than 1-1/2 inch. Expansion shields shall have a load-carrying strength of not less than 600 pounds per anchor.

d. Submit Installation Drawings for metal toilet partitions and urinal screens showing plans, elevations, details of construction, hardware, reinforcing and blocking, fittings, mountings and escutcheons. Indicate on drawings the type of partition, location, mounting height, cutouts, and reinforcement required for toilet-room accessories.

3.3 FLOOR-ANCHORED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level tops of doors with tops of pilasters when doors are in a closed position. Expansion shields shall have a minimum 2-inch penetration into the concrete slab.

3.4 OVERHEAD-BRACED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Secure overhead brace to the pilaster face with not less than two fasteners per face. Expansion shields shall have a minimum 2-inch penetration into the concrete slab. Make tops of doors parallel with the overhead brace when doors are in a closed position.

3.5 FINAL ADJUSTMENT

After completion of the installation, make final adjustments to the pilaster-leveling devices, door hardware, and other working parts of the partition assembly. Doors shall have a uniform vertical edge clearance of approximately 3/16 inch and shall rest open at approximately 30 degrees when unlatched.

3.6 CLEANING

Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Clean all surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner compliant with the manufacturer's recommended cleaning and protection from damage procedures until accepted. Remove all equipment, tools, surplus materials, and work debris from the site.

-- End of Section --

SECTION 10 22 13

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wire mesh partitions;

Show layout, details, materials, dimensions, finishes, and all information necessary for fabrication and installation.

SD-03 Product Data

Wire mesh partitions;

Submit for each type of partition and door.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in manufacturer's original, unopened containers or packaging with labels intact and legible. Deliver, store, and handle

materials so as to prevent damage. Replace damaged or defective materials with new.

1.4 NOT USED

1.5 DESCRIPTION OF WORK

Wire mesh partitions shall be all wire type, heavy duty for extra heavy industrial use, and shall be provided complete with fasteners, capping bars, adjustable floor sockets, bracing, doors, hardware, and other items necessary for a complete, useable, and rigid installation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Shapes, Plates, and Bars

ASTM A36/A36M.

2.1.2 Cold-Formed Steel

AISI SG03-3.

2.1.3 Wire Mesh

Carbon steel wire, woven diamond mesh, intermediate crimped.

2.1.4 Floor Sockets

Cast or forged steel or ductile iron, adjustable, approximately 2-1/2 inches high.

2.2 NORMAL DUTY PARTITIONS

2.2.1 Wire Mesh

10 gage wire, 1-1/2 inch mesh.

2.2.2 Vertical Frames

1-1/4 by 5/8 inch cold-rolled C section channels or 1-1/4 by 5/8 by 1/8 inch channels.

2.2.3 Horizontal Frames

1 by 5/8 inch channels.

2.2.4 Center Reinforcing Bar

One 1 by 1/2 by 1/8 inch channel with all wires woven through, or two 1 by 3/8 by 1/8 inch channels bolted together with mesh in between.

2.2.5 Capping Bar

2-1/4 by one by 1/8 inch channel or 2 by 1/4 inch flat bar.

2.2.6 Corner Posts

Structural steel angles, 1-1/4 by 1-1/4 by 1/8 inch.

2.2.7 Line Posts

Unless otherwise indicated, provide partitions more than 12 feet high with flat bar line posts bolted between vertical frame channels. Sizes of posts shall be as follows:

Partition Height	Size of Posts
12 feet to 14 feet 8 inches	1-3/4 by 5/16 inch or 2 by 1/4 inch
14 feet 8 inches to 19 feet 8 inches	2-1/2 by 5/16 inch
19 feet 8 inches to 23 feet 8 inches	3 by 5/16 inch

2.2.8 Hinged Doors

Frames shall be 1-1/4 by 1/2 by 1/8 inch channels with 1-1/4 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-3/8 by 3/4 by 1/8 inch angle riveted to the lock stile. Provide 1 1/2 pairs of regular weight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

2.2.9 Sheet Metal Base

Hot- or cold-rolled sheet steel, not lighter than 16 gage.

2.3 HEAVY DUTY PARTITIONS

2.3.1 Wire Mesh

6 gage wire, 2 inch mesh.

2.3.2 Panel Frames

1-1/2 by 3/4 by 1/8 inch steel channels.

2.3.3 Center Reinforcing Bar

One 1-1/2 by 3/4 by 1/8 inch channel with all wires woven through, or two 1-1/4 by 3/8 by 1/8 inch channels bolted together with mesh in between.

2.3.4 Capping Bar

Structural steel channel, 3 inch by 4.1 pounds.

2.3.5 Corner Posts

Structural steel angles, 1-3/4 by 1-3/4 by 1/8 inch.

2.3.6 Line Posts

Unless otherwise indicated, provide partitions with flat bar line posts bolted between vertical frame channels. Sizes of posts shall be as follows:

Partition Height	Size of Posts
7 feet to 12 feet	2-1/2 by 5/16 inch
12 feet to 16 feet	3 by 5/16 inch or 2-1/2 by 3/8 inch
16 feet to 20 feet	3-1/2 by 5/16 inch

2.3.7 Hinged Doors

Frames shall be 1-1/2 by 3/4 by 1/8 inch channels with 1-1/2 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-5/8 by 7/8 by 1/8 inch angle riveted to the lock stile. Provide 1-1/2 pairs of heavyweight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

2.4 DOOR OPENING FRAMES

Provide frames the same size and shape as the vertical frames for the mesh panels.

2.5 LOCKS

Provide each door with a mortise type lock as coordinated with the COR.

2.6 FABRICATION

2.6.1 Standard Panels

Wire shall be woven into diamond mesh, intermediate crimped, and securely clinched to frames. Joints shall be mortised and tenoned. Wire shall be continuous at center reinforcing bars, either woven through a single channel or bolted between two channels. Panel vertical frames shall have 3/8 inch bolt holes 18 inches o.c. for heavy duty partitions.

2.6.2 Doors

Construction shall be similar to that specified for panels. Wire mesh shall be the same as that used in the adjacent partition panels.

2.6.3 Finish

Thoroughly clean ferrous metal, treat with phosphate, and paint with gray enamel in the shop.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wire Mesh Partitions

Install plumb, level, and true to line, within a tolerance of 1/8 inch in 10 feet or the height or run of the partition, if less than 10 feet. Anchor floor sockets to the floor with expansion bolts. Vertical frames and posts

shall be bolted together with 3/8 inch bolts 18 inches o.c. for heavy duty partitions. Secure top frames to a continuous capping bar with 1/4 inch diameter U bolts not more than 28 inches o.c.

3.1.2 Doors

Install in accordance with the manufacturers' recommendations. Adjust as required so that doors and hardware operate freely and properly.

3.1.3 Bracing

Brace free standing partitions more than 20 feet in length, at intervals not greater than 20 feet with a steel channel brace connected to the capping bar and anchored to the building wall or framing member.

3.1.4 Touch-Up

Clean and paint scratches, abrasions, and other damage to shop painted surfaces to match the shop-applied finish.

-- End of Section --

SECTION 10 26 13

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B221	(2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D 256	(2010) Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D 543	(2006) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E 84	(2011a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 21	(2009) Determining Resistance of Synthetic Polymeric Materials to Fungi

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2010; TIA 10-2) Standard for Fire Doors and Other Opening Protectives

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(2005) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards;
Wall Guards (Bumper Guards);
Wall Covering/Panels;

SD-04 Samples

Finish;

1.3 NOT USED

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep materials dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 70 degrees F for at least 48 hours prior to installation.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

To the maximum extent possible, corner guards, door and door frame protectors, wall guards (bumper guards), wall panels and wall covering shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Provide resilient material consisting of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic conforming to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 18 ft-lbs/sq. inch when tested in accordance with ASTM D 256, (Izod impact, ft-lbs per sq inch notched).

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.4 Chemical and Stain Resistance

Materials shall be resistant to chemicals and stains reagents in accordance with ASTM D 543.

2.1.1.5 Fungal and Bacterial Resistance

Materials shall be resistant to fungi and bacteria in accordance with ASTM G 21, as applicable.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards

Corner guard units shall be surface mounted type, radius formed to profile shown. Corner guards shall be 8 feet high. Mounting hardware, cushions, and base plates shall be furnished. Assembly shall consist of a snap-on corner guard formed from high impact resistant resilient material, mounted on a continuous aluminum retainer. Extruded aluminum retainer shall conform to ASTM B221, alloy 6063, temper T5 or T6. Flush mounted type guards shall act as a stop for adjacent wall finish material. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards. Flush mounted corner guards installed in fire rated wall shall maintain the rating of the wall. Insulating materials that are an integral part of the corner guard system shall be provided by the manufacturer of the corner guard system. Exposed metal portions of fire rated assemblies shall have a paintable surface.

2.2.2 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 18 gauge thick material conforming to ASTM A167, type 302 or 304. Corner guards shall be 8feet high. Corner guard shall be formed to dimensions shown.

2.3 WALL COVERING/PANELS

Provide wall covering/panels consisting of high impact rigid acrylic vinyl or polyvinyl chloride resilient material. Panel sizes shall be 4 x 8 feet. Submit fire rating and extinguishing test results for resilient material. Also submit statements attesting that the items comply with specified fire and safety code requirements.

2.3.1 Rigid Vinyl Acrylic Wall Covering

Wall covering thickness shall be 0.040 inch.

2.4 TRIM, FASTENERS AND ANCHORS

Provide vinyl trim, fasteners and anchors for each specific installation as shown.

2.5 FINISH

Submit three samples indicating color and texture of materials requiring color and finish.

2.5.1 Aluminum Finish

Finish for aluminum shall be in accordance with AA DAF45. Exposed aluminum shall be designation AA-C22A31 chemically etched medium matte, with clear anodic coating, AA-C22A32 chemically etched medium matte with integrally colored anodic coating class II architectural coating 0.4 mil thick. Concealed aluminum shall be mill finish as fabricated, uniform in natural color and free from surface blemishes.

2.5.2 Stainless Steel Finish

Finish for stainless steel shall be in accordance with ASTM A167, Type 302 or 304, finish number 4.

2.5.3 Resilient Material Finish

Finish for resilient material shall be embossed stipple texture with colors in accordance with SAE J1545.

2.6 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.7 COLOR

Color shall be as indicated on the drawings and selected from manufacturers standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

3.1.2 Door, Door Frame Protectors, and Wall Panels

Surfaces to receive protection shall be clean, smooth, and free of obstructions. Protectors shall be installed after frames are in place, but prior to hanging of doors, in accordance with manufacturer's specific instructions. Adhesives shall be applied in controlled environment in accordance with manufacturer's recommendations. Protection for fire doors and frames shall be installed in accordance with NFPA 80.

3.1.3 Stainless Steel Guards

a. Mount guards on external corners of interior walls, partitions and columns as in accordance with manufacturer's recommendations.

b. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards as indicated and expansion bolted to concrete or masonry with four 3/8 inch diameter bolts, spaced 16 inches on centers. Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Corner guards shall overlap finish plaster surfaces.

c. Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, anchor corner guards to existing walls with 1/4 inch oval head stainless steel countersunk expansion or toggle bolts. Grout spaces solid between guards and backing with portland cement and sand mortar.

d. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

e. For wall guards, space brackets at no more than 3 feet on centers and anchor to the wall in accordance with the manufacturer's installation instructions.

-- End of Section --

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1036 (2006) Standard Specification for Flat Glass

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes;
Accessory Items;

SD-04 Samples

Finishes;
Accessory Items;

1.3 DELIVERY, STORAGE, AND HANDLING

Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited for use with the supporting construction. Provide tamperproof design exposed fasteners with finish to match the accessory.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

Metal	Finish
Stainless steel	No. 4 satin finish

2.2 ACCESSORY ITEMS

Conform to the requirements for accessory items specified below. Submit fasteners proposed for use for each type of wall construction, mounting, operation, and cleaning instructions and one sample of each other accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted. Submit certificate for each type of accessory specified, attesting that the items meet the specified requirements.

2.2.1 Facial Tissue Dispenser (FTD)

Provide surface mounted facial tissue dispenser, Type 304 stainless steel face, satin finish. Secure face of recessed dispenser by friction with suitable spring steel clips. Provide a minimum capacity of 150 two-ply tissues for dispenser.

2.2.2 Grab Bar (GB)

Provide an 18 gauge, 1-1/4 inch grab bar OD Type 304 stainless steel. Provide form and length for grab bar as indicated. Provide concealed mounting flange. Provide grab with satin finish. Furnish installed bars capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 1-1/2 inch space between wall and grab bar.

2.2.3 Mirrors, Glass (MG)

Provide Type I transparent flat type, Class 1-clear glass for mirrors. Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.4 Paper Towel Dispenser (PTD)

Provide paper towel dispenser constructed of a minimum 0.03 inch Type 304 stainless steel, surface mounted. Furnish tumbler key lock locking mechanism.

2.2.5 Sanitary Napkin Disposer (SND)

Construct a Type 304 stainless steel sanitary napkin disposal with removable leak-proof receptacle for disposable liners. Provide fifty disposable liners of the type standard with the manufacturer. Retain receptacle in cabinet by tumbler lock. Provide disposer with a door for inserting disposed napkins, surface mounted.

2.2.6 Sanitary Napkin and Tampon Dispenser (SNTD)

Provide sanitary napkin and tampon dispenser surface mounted. Dispenser, including door of Type 304 stainless steel that dispense both napkins and tampons with a minimum capacity of 20 each. Furnish dispensing mechanism for complimentary operation. Hang doors with a full-length corrosion-resistant steel piano hinge and secure with a tumbler lock. Provide keys for coin box different from the door keys.

2.2.7 Soap Dispenser (SD)

Provide soap dispenser surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.8 Toilet Tissue Dispenser (TTD)

Furnish Type II - surface mounted toilet tissue holder with two rolls of standard tissue mounted horizontally. Provide stainless steel, satin finish cabinet.

2.2.9 Waste Receptacle (WR)

Provide Type 304 stainless steel waste receptacle, designed for surface mounting. Provide reusable liner, of the type standard with the receptacle manufacturer. Provide a minimum 15 cubic feet capacity. Provide receptacles with push doors and doors for access to the waste compartment with continuous hinges. Furnish tumbler key lock locking mechanism.

2.2.10 Toilet Seat Cover Dispenser (TSCD)

Provide Type 304 stainless steel with surface mounted toilet seat cover dispensers. Provide dispenser with a minimum capacity of 500 seat covers.

2.2.11 Mop and Broom Holder (MH)

Stainless steel with grip jaw cam mechanism securing 4 mop or broom handles. Also includes hooks and storage shelf.

PART 3 EXECUTION

3.1 INSTALLATION

Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Provide oval exposed screw heads. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the

installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone or polysulfide sealant) as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates.Install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

-- End of Section --

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFC	(2009) International Fire Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1	(2009) Fire Code
NFPA 10	(2010) Standard for Portable Fire Extinguishers
NFPA 101	(2012) Life Safety Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.157	(2003) Portable Fire Extinguishers

UNDERWRITERS LABORATORIES (UL)

UL 299	(2002; Reprint Apr 2009) Dry Chemical Fire Extinguishers

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit Manufacturer's catalog and warranty data for the following items:

Cabinets;
Wall Brackets;

1.3 DELIVERY, HANDLING, AND STORAGE

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

PART 2 PRODUCTS

2.1 NOT USED

2.2 NOT USED

2.3 NOT USED

2.4 NOT USED

2.5 CABINETS

2.5.1 Material

Provide corrosion-resistant steel cabinets.

2.5.2 Type

Provide semi-recessed cabinet for a 4-inch wall.

2.5.3 Size

Dimension cabinets to accommodate the specified fire extinguishers.

2.6 WALL BRACKETS

Provide wall-hook fire extinguisher wall brackets.

Provide wall bracket and accessories as approved.

PART 3 EXECUTION

3.1 INSTALLATION

Install where indicated on the drawings. Verify exact locations prior to installation.

Comply with the manufacturer's recommendations for all installations.

3.2 ACCEPTANCE PROVISIONS

3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

3.2.2 Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

-- End of Section --

SECTION 11 13 10

DOCK LEVELERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS C2.18	(1993; Errata 1993) Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A143/A143M	(2007) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA MG 1	(2009) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 943 (2006; Reprint May 2010) Ground-Fault Circuit-Interrupters

1.2 DEFINITIONS

1.2.1 Industrial Dock Leveler

A manufactured structure designed to span and compensate space and height differentials between a loading dock and freight carrier to facilitate safe, efficient, freight transfer.

1.2.2 Adjustable Loading Ramp

Synonym for Fixed Type Industrial Dock Leveler.

1.2.3 Fixed Type Industrial Dock Leveler

A dock leveler that is permanently affixed to the dock structure, and usually incorporating an electro-hydraulic recessed into dock face further than 15 inch system to position the dock leveler with respect to the freight carrier at the lip end while being fixed at the opposite hinged end.

1.2.4 Velocity Fuse

A valve or similar device that goes into the hydraulic line. If the dock leveler becomes inadvertently or accidentally unsupported, this fuse will freeze the movement of dock leveler within 4 inches of the dock leveler original position.

1.2.5 Carrier

A wheeled, enclosed trailer or container that, when attached to a heavy-duty truck or van, is used to carry bulk freight over long distances.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Loading Dock Levelers; G
Dock Bumpers; G

SD-04 Samples

Fastening Materials
Angles
Rods
Fastening Hardware

Dock Bumpers
Rubber Rubberized
Fabric

SD-07 Certificates

Fastening Materials
Rubberized Fabric
Steel Angles
Hardware Items

SD-10 Operation and Maintenance Data

Loading Dock Levelers, Data Package 3; G

SD-11 Closeout Submittals

Record Drawings; G

1.4 QUALITY ASSURANCE

1.4.1 Manufacturer's Representative

Furnish services of Fixed Type Industrial Dock Leveler technicians, experienced in installation and operation of the type of system being provided, to supervise installation, testing, adjustment of system, and instruction to Government personnel.

1.4.2 Detail Drawings

Submit drawings depicting dimensions, tolerances, surface finishes, hardness, flush edge angles, method of mounting and anchoring, and control schematics and diagram. Show complete wiring, schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show proposed layout and anchorage of equipment and appurtenances on Drawings. Show the concrete pit details including flush edge angles, dock bumpers including fastening materials in compliance with ASTM A123/A123M and ASTM D 2000, and sloped pit bottom; method of mounting and anchoring; and location of control stations and disconnect switches on Drawings. For vertical, edge-of-dock, and free-standing board dock levelers, show details of required pit or foundation construction and dock bumpers and structural shapes installation, in lieu of concrete pit details on Drawings. Show all proposed dock bumper locations on drawings.

1.4.3 Record Drawings

Submit record as-built drawings depicting dimensions, tolerances, surface finishes, harnesses, flush edge angles, method of mounting and anchoring, and control schematics and diagram, including mechanical and electrical components, testing and acceptance (one copy sepia transparency) for each industrial dock leveler.

1.5 DELIVERY, STORAGE, AND HANDLING

Matchmark and tag parts which are disassembled for shipment with metal tags. Provide waterproofed tags and markings. Protect the delivered equipment in

storage from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.6 EXTRA MATERIALS

After approval of the detail drawings, and not later than 2 months prior to the date of beneficial occupancy, provide spare parts data for each different item of material and equipment specified. Furnish a complete list of parts and supplies, with current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 3 year(s) of service.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Standard Products

Submit data including a complete list of equipment and materials, manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Provide materials and equipment, which are the standard products of a manufacturer regularly engaged in the manufacture of the products, and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this Section, with the additions and modifications specified herein.

2.1.2 Exposed Surfaces

All exposed metal surfaces and fastening materials shall fully comply with the minimum requirements of ASTM A123/A123M, ASTM A143/A143M, and ASTM A153/A153M.

2.1.3 Nameplate

Attach corrosion-resistant metal plate securely and legibly on the exterior surface of the dock leveler. Include the following information indented or embossed on the plate:

a. Description of the equipment: Describe procedures for operating and services equipment, and warnings or cautions of hazardous procedures.

b. Name of the manufacturer.

c. Serial and model number.

d. Rated capacity in pounds.

e. Shipping weight.

f. Date of manufacture (month and year).

2.1.4 Toe Guards or Skirts

Provide sides or edges, except front and rear edges, of the ramps which rise above the surrounding loading dock with sheet carbon steel skirts or toe guards of minimum 14 U.S.S. gage nominal thickness. Furnish smooth faced toe guards or skirts and mount flush with the edges of the ramp surface. Ensure sufficient depth of toe guards or skirts to protect the full operating range of dock travel. Ensure the construction capable of resisting a minimum lateral force of 10 pounds with a maximum deflection of 1/2 inch.

2.2 LOADING DOCK LEVELERS

Provide permanent loading dock levelers with minimum performance characteristics based on the following:

a. Service Period:
   (1) Number of shift operations: 2.
   (2) Maximum number of trucks per shift opening: 4.
   (3) Maximum number of days per week: 7.

b. Fork Lift Loads:
   (1) Design levelers to accommodate 3 and 4 wheel fork trucks.
   (2) Design levelers to handle 20,000 LB gross dynamic load.
   (3) Base load leveler design on number of cycles per loading/unloading operation per truck.

Provide loading dock leveler with electro-hydraulic type with electric motor and hydraulic pump operating a hydraulic cylinder that adjusts dock leveler board position. Make provision for maintenance access to understructure and lifting mechanism. Provide steel tread plate lip and platform, hinged and supported from beneath by steel framework that contains lifting, positioning, and lowering assembly. Ensure that platform surface is flush with surrounding floor surface of loading dock when not in service. Provide integral positive restraint when leveler is in maintenance position.

2.2.1 Design Requirements

Design, fabricate, and finish loading ramp to permit washing with water and detergents, and operating in an ambient temperature from 0 to plus 110 degrees F.

2.2.2 Dock Leveler Height Adjustment

Provide a ramp whose incline can be adjusted to suit the height of the freight carrier. Allow the loading ramp a minimum of 24 inches of vertical adjustment. Divide height adjustments 12 inches above and 12 inches below the dock level to provide coverage between 30 and 54 inches and 44 inches above grade.

2.2.3 Dock Leveler Extension and Retraction

Extend non-fixed end of the dock leveler from a retracted position behind the line of the loading dock platform bumpers to at least 12 inches beyond the forward edge of the dock platform bumpers so as to rest on the bed of the freight carrier. The difference in length of the platform from its fully retracted position to its fully extended position shall be practically constant throughout the ramp, including the ramp extension.

2.2.4 Loading Ramp Compensation

Provide automatic compensation with ramp platform loaded or unloaded for:

2.2.4.1 Freight Carrier Out of Level

Out of level freight carrier bed condition (difference in elevation from side to side at the rear of the carrier bed): Allow a minimum correction of one inch for each 18 inches and maximum 4 inch correction of ramp width over the width of the ramp. Ensure the rear edge of the ramp parallel with the rear of the frame in order to prevent tripping or be a pinching hazard.

2.2.4.2 Loading and Unloading of the Freight Carrier

Provide mechanical type dock levelers with manual load compensation for truck beds lowered below dock height. When the lip is extended so as to rest on the bed of motor truck or trailer, provide compensation of 4 inches for carrier spring deflection so that contact will be maintained between lip and carrier bed.

2.2.5 Safety Devices

2.2.5.1 Electro-Hydraulic System

Provide velocity fuse, ballcheck valve, or other device to automatically prevent a drop of more than 4 inches of the lip, should the freight carrier move away from the dock leaving the lip unsupported. Activate this device with a static, dynamic, or impact load exceeding 10 percent of the rated load on the lip and ramp.

2.2.5.2 Dock Bumpers

Submit certificates showing conformance with the referenced standards contained in this section. Provide ramp and load dock face with laminated rubber, tire-fabric, or equivalent dock bumpers recommended by the dock leveler manufacturer. Submit one typical Loading Dock Bumper completely assembled with supporting rods, end angles, bolts, and nuts. (This may be the smallest size bumper required.) One section of 8 inches wide by full depth and height of bumper including one end angle with the opposite end exposed for inspection.Solid Rubber pieces conforming to ASTM D 2000, Grade 4AA612A13B13F17 may be used instead of rubberized fabric.

a. Construct bumpers of resilient, laminated, rubberized-fabric pads, assembled on steel frames. Rubberized Fabric shall conform to ASTM D 2000. Punch material to receive 3/4 inch supporting rods. Bumpers shall be 4-1/2 inches thick, stand out from the dock, and be closed with two structural steel angles under 1,500 pounds.

b. Finish: Metal for dock bumpers, including Hardware Items, shall be hot-dip galvanized conforming to ASTM A123/A123M.

2.2.6 Rated Capacity

Minimum 20,000 pounds roll over capacity.

2.2.7 Ramp Load Carrying Surface

The live load carrying surface of the ramp shall be 6 feet plus or minus 3 inch wide and 10 feet plus or minus 9 inch long with the dock leveler lip retracted.

2.3 OPERATION

2.3.1 Electro-Hydraulic Control

Provide each dock leveler with a pushbutton station to activate motor, pump, and valves.

2.3.1.1 Pushbutton

Heavy-duty dust tight and oil tight type rated in accordance with NEMA ICS 2, Part ICS2-216 for alternating current. To prevent accidental operation and damage, ensure each button to be recessed in its station or be protected by a peripheral collar (ring) or shroud. Indelibly identify each pushbutton by means of cast or etched letters on the station. Provide emergency "STOP" button of momentary type with manual reset or continuous pressing (constant pressure) type. This stop button shall stop all dock leveler movement, regardless of the position of the ramp or lip at the time the "STOP" button is depressed.

2.3.1.2 Hinged Lip Ramp Movement

Apply continuous pressure on the "UP" button to raise the loading ramp, descend the lip onto the bed of the freight carrier. Once the freight carrier has departed, the lip shall automatically fall or retract to its down position, and the ramp shall return to its stored dock level position. The ramp, in its stored position, shall have the capability of being lowered below dock level without extending the lip of the ramp to service truck end loads which may be lower than loading dock surface position. Allow 4 to 6 seconds to fully extend or retract the lip.

2.4 CONSTRUCTION AND MATERIALS

Construct all load carrying parts of forged or welded steel. The entire live load carrying surface of the ramp and rear attachment shall be not less than 1/4 inch thick, 55 ksi minimum yield strength, low alloy, nonskid steel tread plate. Provide minimum 5/8 inch vertical projections on the live load carrying surface. Bevel the lip or ramp extension. Design load carrying surfaces to permit free movement of powered hand or platform trucks, low lift pallet trucks, and fork lift trucks. Fabricate lip hinge of not less than 1/4 inch wall seamless steel tubing.

2.5 ELECTRO-HYDRAULIC SYSTEM

Provide a separate and complete system for each dock leveler. Include an electric motor, motor drive, hydraulic pump, hydraulic ram, pressure relief valve, fluid reservoir, strainer, filter, hydraulic control-valve cylinders, hose, piping, fittings, and hydraulic fluid. Incorporate a means for filling and draining hydraulic fluid. Design cylinders, pump, and control valves to withstand not less than 150 percent of the design operating pressure. Provide hydraulic hose, fittings, pipe, and tubing with working pressures based upon a minimum 4 to 1 safety factor of bursting pressure.

2.6 ELECTRICAL REQUIREMENTS

NFPA 70, NEMA ICS 2, NEMA ICS 6 and NEMA MG 1. Provide 230 volt electrical characteristics, three phase, 60 Hz alternating current power supply. Provide all electrical equipment on the loading ramp. Provide interconnecting wiring for components of packaged equipment as an integral part of the equipment. Include motor, switches, junction box, conduit, wiring cables, panel enclosed control station, motor controller, heater coils, timer, transformer, terminal blocks, and fuses. Provide NEMA ICS 6, Type 4, electrical enclosures. Color code all wiring.

2.6.1 Motor

Conform to NEMA MG 1 and continuous duty or 60-minute time rated, industrial type, single speed rated for operating conditions. Provide electrical insulation systems conforming to NEMA MG 1, Class B. Provide permanently lubricated antifriction ball or roller bearings. Equip each electrohydraulic loading dock leveler with a totally enclosed fan cooled (TEFC) squirrel cage induction electric motor. Equip each air powered loading dock leveler with a 115v, single phase, 60 Hz, self cleaning, two stage, UL approved industrial fan motor, which will not exceed its rated capacity under full load conditions of the loading dock leveler.

2.6.2 Controls

NEMA ICS 2, size 0 controller for heavy industrial service. Provide an electrically operated, full magnetic, nonreversing type controller for the motor. Equip all control enclosures with locks and keys.

2.6.3 Transformer

Totally enclosed, self-cooled, dry type. Feed the transformer from the load side of the main disconnecting device. Incorporate circuit breakers with ground fault interrupting protection conforming to UL 943.

2.7 ACCESSORIES

2.7.1 Dock Bumpers

Provide bumpers capable of sustaining repeated impacts from trucks or trailers without damage to the dock, dock levelers, or bumpers.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

Install and adjust in accordance with NFPA 70, manufacturer's approved detail drawings, and as-built system assembly drawings. Install controls so operator can see dock leveler while manipulating controls. Do not pour the pit for the adjustable loading ramp until the design and detail drawings have been approved. If the pit size is limited by construction conditions

involved, alter the dock leveler equipment to fit the pit. Clearly indicate these alterations or modifications on the drawings. Check and verify the appropriate measurements at the building. Do not exceed 2 inch clearances between the ramp and pit.

3.3 CLEANING, TREATMENT AND PAINTING

In accordance with manufacturer's standard practice, shop clean, treat and paint ferrous surfaces including platform, lip, frame, springs, motor, pump, cylinders, valves, and any other non-cadmium plated or non-galvanized surface (but not including bearings, gear contact surfaces, parts protected by lubrication, or other surfaces not usually painted or coated). Clean ferrous surfaces, shot pen, and protect the base metal with an application of 99.9 percent pure zinc coating with a thickness of 0.010 to 0.012 in accordance with AWS C2.18 and protect the base metal with an application of Rustoleum paint with a thickness of 2.5 to 3 mils followed by a final coat of standard primer with a thickness of 2.5 to 3 mils. Protect nonferrous parts against corrosion as necessary.

3.3.1 Workmanship

Conduct field touch-up work as to avoid damaging other surfaces and public property in the area. Do not apply field applied paint during foggy, damp, rainy weather, or the ambient temperatures below 45 degrees F and above 95 degrees F.

3.3.2 Dissimilar Metals Protection

Insulate control surfaces by electrolytically inactive materials.

3.3.3 Finish Coat Color

Brilliant yellow and black. Paint 3 inch wide black and yellow diagonal stripes on all vertical surfaces of pit, skirts, and platform edges exposed above adjacent surfaces at any ramp position. Paint similar stripes on top of ramp surfaces in 6 inch wide band around outside edges (except for fixed edge).

3.4 FIELD TESTS

Provide personnel, instruments, materials, and equipment, including test vehicles, for the administration and direction of the tests. Correct defects and repeat tests under the cognizance of the Contracting Officer and the dock leveler manufacturer. The Contracting Officer is responsible for certifying the test load.

3.4.1 Roll-Over Load Tests

Move roll-over load of 20,000 pounds over the dock leveler between the bed of a freight carrier and the building loading dock surface for 10 cycles. With the ramp extension retracted and the ramp platform leveled with the building loading dock surface, run a 20,000 pound roll-over load over the ramp in various directions for 20 cycles. Do not allow permanent deformation or hydraulic system leakage to occur subsequent to examination after these roll-over tests.

3.4.2 Drop Tests

Twice, drop test the dock leveler at the indicated rated capacity as follows: With the load on the platform and the lip resting on a vehicle carrier bed not less than 10 inches above loading dock surface, pull the carrier or pull away from the lip, leaving the loading ramp unsupported. Do not exceed 4 inch for the measured vertical drop of the dock leveler taken at the point where the lip rests on the vehicle carrier during each of the drop tests. Inspect the loading ramp after each drop and ensure no damage or distortion to the mechanical, electrical or structural components. Do not allow leakage from the hydraulic system.

3.4.3 Acceptance Tests

Perform an acceptance test in the presence of the dock leveler manufacturer and the Contracting Officer subsequent to roll-over load tests and drop tests. Conduct operation of the equipment through all of its motions and specified checks as follows: (a) extend lip to rest on a variety of freight carriers with beds up 12 inch above and below dock level; (b) test 4 inch drop limitation with 7000 pound load on ramp, evenly distributed; (c) test level compensation with the ramp, loaded with a minimum of 7000 pounds; and (d) test proper compensation (float) for various compression of countersprings, with ramp loaded and unloaded.

3.5 INSTRUCTION TO GOVERNMENT PERSONNEL

Upon completion of the work and at a time designated by the Contracting Officer, provide the services of a competent Technician regularly employed or authorized by the manufacturer of the dock leveler to instruct Government personnel in the proper operation, maintenance, safety, and emergency procedures of the dock leveler. A minimum of one and no more than two eight-hour working days of instruction is required. Conduct the training at the job site or at any other location mutually satisfactory to the Government and the Contractor.

3.6 OPERATING MANUALS

Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. List routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides in the maintenance manuals. Also include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

-- End of Section --

SECTION 12 21 00

WINDOW BLINDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2004) Fire Tests for Flame Propagation of Textiles and Films

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES

SD-03 Product Data

Window Blinds;
Hardware;
Installation

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Samples

Window Blinds;
Hardware;

Samples of each type and color of window treatment. Provide plastic vertical louvers 6 inch in length for each color. Track must be 6 inch in length. Shade material must be minimum 6 by 6 inch in size.

SD-06 Test Reports

Window Blinds

Fire resistance, Flame Spread, and smoke contribution data.

SD-08 Manufacturer's Instructions

Window Blinds;

SD-10 Operation and Maintenance Data

Window Blinds;

1.3 GENERAL REQUIREMENTS

Provide window treatment, conforming to NFPA 701, complete with necessary brackets, fittings, and hardware. Each window treatment type must be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Mount and operate equipment as per manufacturer's instructions. Windows to receive a treatment must be completely covered.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above 50 degrees F. Do not open containers until needed for installation unless verification inspection is required.

1.5 FIELD MEASUREMENTS

Become familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Provide each blind, including hardware, accessory items, mounting brackets and fastenings, as a complete unit produced by one manufacturer. All parts must be one color, unless otherwise indicated, to match the color of the blind slat. Treat steel features for corrosion resistance.

2.1.1 Vertical Blinds

Provide vertical blind units capable of nominally 180 degree partial tilting operation and full stackback. The blinds must be listed by the manufacturer as designed for heavy duty strength applications including heavy duty hardware. Provide vertical blinds to be wall mounted with inside brackets. Blinds must be sill length. Outside mount type installation must provide adequate overlap to control light and privacy.

2.1.1.1 Louvers

Provide louvers which are fire resistant solid vinyl, UV stable, and impact resistant; having a bottom chain. Louvers that are 3-1/2 inch must overlap not less than 3/8 inch.

2.1.1.2 Carriers

Provide carriers to support each louver. Provide carriers made of molded plastic to transverse on self-fabricated wheels for smooth, easy operation.

The hook of the carrier must have an automatic latch to permit easy installation and removal of the louver, and to securely lock the louver for tilting and traversing.

2.1.1.3 Headrail System

Provide headrail system not less than 0.047 inch thick and made of anodized aluminum alloy or 0.027 inch thick phosphate treated steel with a baked on ivory gloss enamel paint finish. The headrail must extend the full width of the blind and be closed with an end cap at each end. One cap must contain the traversing and tilting controls. The opposite cap will house the pulley for the traversing cord.

2.1.1.4 Valance

Attach the manufacturer's standard valance to the headrail by metal holders which grip the top and bottom edge of the valance and accept an insert of the same material as the slats. Provide sufficient clearance behind the valance to permit the louvers to tilt without interference. The headrail cover must extend the full width of the blind.

2.1.1.5 Controls

Provide tilting and traversing controls that hang compactly at the side of the blinds and reach within 40 inches of the floor. The tilt/traverse control must tilt all vanes simultaneously to any desired angle and hold them at that angle. Provide louvers that traverse one way to the right. The traversing control cord must be minimum 0.070 inch in diameter with a minimum breaking strength of 125 pounds. Anchor the cord to a lead carrier linked to all adjacent carriers. Provide louvers that traverse along the headrail by pulling one side of the looped cord a fiberglass wand that tilts the louvers by turning the wand and traverses the louvers by using the wand as a drapery control. Sliding glass doors must have a one way draw with stackback occurring opposite door openings.

2.1.1.6 Connectors and Spacers

The connector must be flexible, smooth and flat to slide unhindered when carriers move independently of each other, and to nest compactly when carriers are stacking. The length of the links must relate to the louver width in order to equally space the traversing louvers, to maintain uniform and adequate overlap of louvers, and to fully cover the width of the opening.

2.2 COLOR

Provide color, pattern and texture as indicated on the drawings selected from manufacturer's standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Vertical Blinds

Perform installation in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.1.2 Valance

Perform installation in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.2 CLEAN-UP

Upon completion of the installation, free window treatments from soiling, damage or blemishes; and adjust them for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Contracting Officer. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, must be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 0.75 inch or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

-- End of Section --

SECTION 12 36 00

COUNTERTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B18.6.1	(1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2009) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM D 4689	(1999; R 2005) Standard Specification for Adhesive, Casein-Type
ASTM D 4690	(1999; R 2005) Standard Specification for Urea Formaldehyde Resin Adhesives
ASTM F 594	(2009e1) Standard Specification for Stainless Steel Nuts
ASTM F 836M	(2002; R 2010) Standard Specification for Style 1 Stainless Steel Metric Nuts

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1	(2000) Performance & Construction Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates

SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION (SEFA)

SEFA 7	(1996) Recommended Practice for Laboratory and Hospital Service Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588	(Rev E; Notice 1) Bolt, Toggle: and Expansion Sleeve, Screw
FS FF-S-325	(Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS TT-C-490	(Rev E) Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings
FS TT-C-520	(Rev B; Notice 1) Coating Compound, Bituminous, Solvent Type, Underbody (for Motor Vehicles)
FS TT-F-336	(Rev E; Notice 2) Filler, Wood, Paste
FS WW-P-541	(Rev E; Am 1) Plumbing Fixtures

1.2 SUBMITTALS

Submitin accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Submit fabrication drawings for Countertop and Backsplash Fabrication, specified in this section.

SD-03 Product Data

Submit Manufacturer's catalog data for the following items:

Corrosion-Resistant Steel
Hardwood
Synthetic resin
Adhesives
Filler Material
Particle Board
Fasteners Steel
Sinks
Service Fixtures
Accessories and Hardware
Plastic Laminate

SD-04 Samples

Include samples for the following:

Countertop and Backsplash, one each, 4 inches in width, submitted as one unit or as separate items.

Accessories and Hardware, one each.

Submit Manufacturer's Standard Color Charts in accordance with paragraph entitled, "General," of this section.

SD-08 Manufacturer's Instructions

Submit Manufacturer's Instructions for in accordance with paragraph entitled, "General," of this section.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle countertops and backsplash in a manner that will prevent damage and disfigurement.

1.4 DESIGN

Provide factory fabricated, prefinished plastic laminate countertops in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Construct countertops as specified and meet the requirements of KCMA A161.1. Accomplish fastenings to permit removal and replacement of individual units without affecting the remainder of the installation. Provide counters with watertight sink rim when indicated. Include removable drawers equipped with position stops to avoid accidental complete withdrawals.

PART 2 PRODUCTS

2.1 GENERAL

Submit Manufacturer's Standard Color Charts for countertops showing the manufacturer's recommended color and finish selections.

Submit Manufacturer's Instructions for countertops including special provisions required to install equipment components and system packages. Include all special notices detailing impedances, hazards and safety precautions.

Provide the manufacturer's standard type countertops or as indicated on the drawings. Accomplish fastenings to permit removal and replacement of individual countertops without affecting the remainder of the installation.

2.2 MATERIALS

Provide Corrosion-Resistant Steel conforming to ASTM A1008/A1008M and ASTM A167, Type 304 Finish 4.

Use thermosetting urea-resin Type II Adhesives for application of plastic laminate conforming to ASTM D 4690 as recommended by the manufacturer of the laminate. Use adhesive for wood members conforming to ASTM D 4689.

Use Filler Material conforming to FS TT-F-336.
Provide Plastic Laminate conforming to ANSI/NEMA LD 3, Style as indicated on drawings.

Provide fasteners conforming to the following:

Screws: ASME B18.6.1, Group, Type and Class as applicable

Anchoring Devices: FS FF-S-325, Group, Type, and Class as applicable

Toggle bolts: FS FF-B-588, Type I, Class A, Style 2

Nuts: ASTM F 594, corrosion-resistant steel

Bolts: ASTM A325, heavy, hexagon head bolts corrosion-resistant steel

Nuts: ASTM F 836M, corrosion-resistant steel

Bolts: ASTM A325M, heavy, hexagon head bolts corrosion-resistant steel

Corrosion-resistant Steel Sinks:

18-gage corrosion-resistant steel, nonintegral, self-rimming

Drain holes in center of bowl

Underside coated with 1/8-inch thick sound deadener

Die-form, seamless, raised edges at front and ends

Cove corners to 1/2-inch radius

Equip with strainers and tail pieces

Sound deadening: conform to FS TT-C-520.

Provide Service Fixtures conforming to the following requirements:

Fixtures: In accordance with the water conservation policy as stated in the Standard Plumbing Codes, Appendix J.

Faucets: Splashback mounted, cast brass, chrome plated, FS WW-P-541

Faucets: Deck mounted, cast brass, chrome plated, FS WW-P-541

Drains, strainers, and taps: Brass, chrome plated, FS WW-P-541

Index buttons: Plastic, color codes in accordance with SEFA 7

Special items: Nipples and locknuts with each fixture will be as directed.

Metal pretreatment coatings: FS TT-C-490, Type I

2.3 COUNTERTOP AND BACKSPLASH FABRICATION

Construct countertops and backsplash of wood covered with a shop-applied plastic laminate.

Specify particle board with a minimum thickness of 3/4 inch. Build up edges and opening around sink rim with hardwood strips. Provide backsplash of similar construction, a minimum of 3/4-inch thick by the height indicated.

Provide continuous sheet laminate of the longest length practicable and of the design and color selected. Provide joints in the surface sheeting that are tight and flush, and held to a practical minimum number.

Edging and trim:

For plastic-laminate-covered countertops and backsplash, provide edging and trim consisting of:

Strips of laminate cut and fitted to exposed edges with contact adhesive

Provide sink rims which are the standard products of a manufacturer regularly producing this type of equipment, fabricated from corrosion-resistant steel of the size necessary to receive the sinks.

2.3.1 High-Pressure Laminated Plastic Clad Countertops

Construct clad countertop and backsplash of 3/4 inch thick, 44 pound density particle board core, post formed cove type or fully formed type. Provide single unit cove type unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash. Provide edging and trim that consists of plastic laminate cut and fitted to all exposed edges. Supply end splashes constructed of 3/4 inch plywood or 3/4 inch thick, 44 pound density particle board core. Provide continuous sheets of longest lengths practicable. Make all joints in surface sheeting tight and flush. When the countertop and backsplash are two separate units, use GP50 plastic laminate. When the countertop and backsplash are one unit, use PF42 plastic laminate. Provide plastic laminate conforming to the requirements of ANSI/NEMA LD 3, with contact type plastic laminate adhesive applied to both surfaces. For fully formed and cove type countertops, the post-forming plastic laminate can not be bent to a radius smaller than the limit recommended by the plastic manufacturer.

2.4 SURFACING

2.4.1 Laminated Plastic Surfacing

Laminate plastic sheeting to faces and exposed edges of particle board at 20 pounds per square inch and 185 degrees F.

Apply backing sheet to concealed faces.

2.4.2 Wood Countertop Finish

Provide factory applied HPDL finish as indicated on all internal and external surfaces.

2.4.2.1 HPDL Finish

Pattern and color: As selected from manufacturer's standard finishes As indicated.

2.5 ACCESSORIES AND HARDWARE

2.5.1 Mounting Adhesives

Provide structural-grade silicone or epoxy adhesives of type recommended by manufacturer for application and conditions of use.

Provide spacers, if required, of type recommended by adhesive manufacturer.

2.5.2 Joint Sealants

Use clear silicone sealant of type recommended by manufacturer for application and conditions of use.

Provide anti-bacterial type in food preparation areas.

2.5.3 Solvent

Use a product recommended by adhesive manufacturer to clean surface of quartz surfacing to assure adhesion of adhesives and sealants.

2.5.4 Cleaning Agents

Use non-abrasive, soft-scrub type kitchen cleaners.

2.6 COLOR, TEXTURE, AND PATTERN

Select color as indicated on the drawings. from manufacturers standard colors. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

Inspect material for defects prior to installation. Ensure materials throughout bear labels with the same batch number. Visually inspect materials used for adjacent pieces to assure acceptable color match. Inspect in lighting conditions similar to those on the project. Repair or replace damaged materials in a satisfactory manner.

Install countertops plumb with cabinetry level to within 1/16 inch in 10 feet. Level base cabinets by adjusting leveling screws. Scribe and fit scribe strips to irregularities of adjacent surfaces. Gap openings exceeding 0.025 inch are not acceptable.

Secure countertops to cabinetry and wall construction usingscrews, spaced 30 inches maximum on center.

3.1.1 Preliminary Installation and Adjustment

Install materials in accordance to manufacturer's recommendations. Lift and place to avoid breakage.

Position materials to verify that materials are correctly sized and prepared. Make necessary adjustments.

If jobsite cutting, grinding, or polishing is required, use water-cooled tools. Protect jobsite and surfaces against dust and water. Perform work away from installation site if possible.

3.1.2 Permanent Installation

After verifying fit, remove quartz surfacing from position, clean substrates of dust and contamination, and clean quartz surfacing back side and joints with solvent.

Apply sufficient quantity of mounting adhesive in accordance with adhesive manufacturer's recommendations to provide permanent, secure installation.

Spacing of mounting adhesive will not exceed:

Horizontal Surfaces: 16 inch on center

Vertical Surfaces: 8 inch on center; provide temporary shims until adhesive cures.

Install surfacing plumb, level, and square and flat to within 1/6 inch in 10 feet.

3.1.3 Joints

Joints between adjacent pieces of quartz surfacing:

Joints must be flush, tight fitting, level, and neat.

Securely join with stone adhesive. Fill joints level with quartz surfacing.

Clamp or brace quartz surfacing in position until adhesive sets.

Joints between backsplashes and countertops: Seal joints with silicone sealer.

3.2 CLEANING

On completion of cabinet installation, touch up marred or abraded finished surfaces. Remove crating and packing materials from premises. Wipe down surfaces to remove fingerprints and markings and leave in clean condition.

3.3 INSPECTION

Examine casework grounds and supports for adequate anchorage, foreign material, moisture, and unevenness that could prevent quality casework installation.

Ensure that electrical and plumbing rough-ins for casework are complete. Do not proceed with installation until defects are corrected.

-- End of Section --

SECTION 21 13 13.00 10

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.1	(2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250
ASME B16.11	(2009) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(2010) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2006) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	(2010) Standard for Square and Hex Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A135/A135M	(2009) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A449	(2010) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A795/A795M	(2008) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM F 436	(2011) Hardened Steel Washers

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2010; Errata 10-1; TIA 10-1; TIA 11-2) Standard for the Installation of Sprinkler Systems
NFPA 1963	(2009; Errata 09-1) Standard for Fire Hose Connections
NFPA 20	(2010; TIA 10-1) Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	(2010) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2011) Building Materials Directory
UL Fire Prot Dir	(2011) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Furnish piping offsets, fittings, and any other accessories as required to provide a complete installation and to eliminate interference with other construction. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage. Provide wet pipe sprinkler system in all areas of the building. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Rack sprinklers shall be in accordance with NFPA 13. Design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the

sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

Hydraulically design the system to discharge a minimum density as shown on the drawings. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 20 ft/s.

1.2.1.1 Hose Demand

Add an allowance for exterior hose streams, as indicated on the drawings, to the sprinkler system demand at the point of connection to the existing system.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 55 psi, and a flow of 1300 gpm at a residual pressure of 28 psi based on a flow test conducted by Poole Fire Protection 9.11.11. The design shall also incorporate the use of a fire pump as specified in 21 30 00 FIRE PUMPS. Water supply shall be presumed available at the connection to the underground. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping. Hydraulic calculations shall be based on operation of the fire pump(s) provided in Section 21 30 00 FIRE PUMPS

1.2.1.3 Hydraulic Calculations

Submit hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments and as outlined in NFPA 13, except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings to substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13, but shall not exceed 100 square feet for extra hazard occupancies, 130 square feet for ordinary hazard occupancies, and 225 square feet for light hazard occupancies.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;
As-Built Drawings

SD-03 Product Data

Fire Protection Related Submittals
Materials and Equipment;
Spare Parts
Preliminary Tests;
Final Acceptance Test;
Onsite Training;
Fire Protection Specialist;
Sprinkler System Installer;

SD-05 Design Data

Hydraulic Calculations;

SD-06 Test Reports

Preliminary Test Report;
Final Acceptance Test Report;

SD-07 Certificates

Inspection by Fire Protection Specialist;

SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals

1.4 QUALITY ASSURANCE

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall

govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.4.1 Fire Protection Specialist

All required shop drawings, calculations, materials, qualifications, test procedures, and test reports shall be submitted to and approved by the Fire Protection Specialist. All final system acceptance testing shall be witnessed and approved by the Fire Protection Specialist. Submit the name and documentation of certification of the proposed Fire Protection Specialists prior to the submittal of the sprinkler system drawings and hydraulic calculations. The Fire Protection Specialist shall prepare and submit a list of the fire protection related submittals. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. The Fire Protection Specialist shall be a registered fire protection engineer in the State of Georgia.

1.4.2 Sprinkler System Installer

Work specified in this section shall be performed by the Sprinkler System Installer who is regularly engaged in the installation of the type and complexity of system specified in the contract documents, and who has served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. Submit the name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

1.4.3 Shop Drawings

Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Submit 3 copies of the Sprinkler System shop drawings, no later than 21 days prior to the start of sprinkler system installation. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall

show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. Submit load calculations for sizing of sway bracing, for systems that are required to be protected against damage from earthquakes.

1.5 DELIVERY, STORAGE, AND HANDLING

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.6 NOT USED

PART 2PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Provide Materials and Equipment that have been tested by Underwriters Laboratories, Inc. and are listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM APP GUIDE. Submit manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, provide a complete equipment list that includes equipment description, model number and quantity.

2.4 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

2.4.1 Steel Piping Components

2.4.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black for piping in interior spaces and galvanized for exterior spaces as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A795/A795M, ASTM A53/A53M, or ASTM A135/A135M. Pipe in which threads or grooves are cut or rolled formed shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut or rolled formed. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.4.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.4.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer;segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A47/A47M, Grade 32510; ductile iron conforming to ASTM A536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.

2.4.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type.

2.4.1.5 Bolts, Nut, and Washers

Bolts shall be conform to ASTM A449, Type 1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts, or as specified by the fitting manufacturer.

2.4.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM APP GUIDE and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.4.3 Valves

2.4.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type unless otherwise indicated on the design drawings. All control valves shall be listed in UL Bld Mat Dir or FM APP GUIDE.

2.4.3.2 Check Valve

Check valve 2 inches and larger shall be listed in UL Bld Mat Dir or FM APP GUIDE. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.5 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

2.6 ALARM INITIATING AND SUPERVISORY DEVICES

2.6.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.6.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.7 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. If used, female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963. Contractor shall coordinate fire department connection specifications with the owner.

2.8 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be ordinary unless otherwise required by NFPA 13. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used unless otherwise indicated.

2.8.1 Concealed Sprinkler

Concealed sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.8.2 Recessed Sprinkler

Recessed sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice. Recessed sprinkler shall be provided in the MSD portion of the building.

2.8.3 Flush Sprinkler

Flush sprinkler shall be chrome-plated quick response type and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.8.4 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, quick-response type (where permitted by NFPA 13) with nominal 1/2 inchor 17/32 inch orifice. Pendent sprinklers shall have a polished chrome finish.

2.8.5 Upright Sprinkler

Upright sprinkler shall be chrome-plated and shall have a nominal 1/2 inch or 17/32 inch orifice. Upright sprinklers shall be quick response where permitted by NFPA 13.

2.8.6 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.

2.8.7 Corrosion Resistant Sprinkler

Corrosion resistant sprinkler shall be the upright or pendent type installed in corrosive environments. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.

2.8.8 Dry Sprinkler Assembly

Dry sprinkler assembly shall be of the sidewall, type and listed for extended coverage use in ordinary hazard occupancies. Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in UL Fire Prot Dir. Sprinklers shall have a polished chrome finish.

2.9 ACCESSORIES

2.9.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.9.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.9.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.9.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers susceptible to mechanical damage. Examples include, but are not limited to, mechanical rooms, elevator pits, high traffic areas, and other areas subject to mechanical impact.

2.9.5 Identification Sign

Valve identification sign shall be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

A hydraulic data placard shall be located at each riser. The placard shall be a permanently marked, weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire or chain. The placard shall contain the following information:

a. Location of design area or areas

b. Discharge densities over the design area or areas

c. Required flow and residual pressure demand at the base of the riser

d. Occupancy classification or commodity classification and maximum permitted storage heigh and configuration

e. Hose stream allowance included in addition to the sprinkler demand

f. The name of the installing contractor

PART 3 EXECUTION

3.1 FIELD MEASUREMENTS

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 13.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

Prior to ceiling installation and concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports. The Fire Protection Specialist shall: 1) inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements, 2) witness the preliminary and final tests, and sign the test results, 3) after completion of the system inspections and a successful final test, certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

Seismically protect the system piping against damage from earthquakes in accordance with NFPA 13.

3.4.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide a minimum headroom of 7'-6".

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches for steel pipe or 6 inches for copper tubing. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the

reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area. Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation.

Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07 84 00 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected at the riser as a combination test and drain valve; a test valve located a maximum of 6 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. All other drain piping shall be piped outside of the building unless otherwise indicated in the design documents. Auxiliary drains shall be provided as required by NFPA 13 and the design documents.

3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade and as shown on the drawings. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Wiring color code shall remain uniform throughout the system.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.7 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. Submit proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests and proposed date and time to begin the preliminary tests. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, submit 3 copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Tests. The Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

3.7.1 Underground Piping

3.7.1.1 Flushing

Existing underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system.

3.7.2 Aboveground Piping

3.7.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.7.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. Provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, pitot tube gauge, plus all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. Provide a metal placard on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.7.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.7.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.8 FINAL ACCEPTANCE TEST

Begin the Final Acceptance Test only when the Preliminary Test Report has been approved. Submit proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests, and proposed date and time to begin the Test, submitted with the procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Submit as-built shop drawings, at least 14 days after completion of the Final Tests, updated to reflect as-built conditions after all related work is completed. Drawings shall be in electronic format. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. Submit 2 copies of the completed Final Acceptance Test Report no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

3.9 ONSITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 1010	(2002) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4	(1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)
ASSE 1010	(2004) Performance Requirements for Water Hammer Arresters (ANSI approved 2004)
ASSE 1018	(2001) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002
ASSE 1019	(2011) Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type (ANSI Approved 2004)
ASSE 1037	(1990) Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites

AWWA B301	(2010) Liquid Chlorine
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(2011) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C652	(2011) Disinfection of Water-Storage Facilities

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2011) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.2/B2.2M	(2010) Specification for Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.14.1	(2003; R 2008) Backwater Valves
ASME A112.19.2/CSA B45.1	(2008; Update 1 2009; Update 2 2011) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
ASME A112.19.3/CSA B45.4	(2008; Update 1 2009; Update 2 2011) Stainless Steel Plumbing Fixtures
ASME A112.36.2M	(1991; R 2008) Cleanouts
ASME A112.6.1M	(1997; R 2008) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2001; R 2007) Standard for Floor and Trench Drains
ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B16.12	(2009) Cast Iron Threaded Drainage Fittings
ASME B16.15	(2011) Cast Bronze Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22	(2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2007) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.50	(2001; R 2008) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME B31.1	(2010) Power Piping
ASME B31.5	(2010) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2010) BPVC Section IV-Rules for Construction of Heating Boilers
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME CSD-1	(2009) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2011) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts

ASTM A193/A193M	(2011) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A515/A515M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A518/A518M	(1999; R 2008) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A733	(2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A74	(2009) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A888	(2011) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B152/B152M	(2009) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B306	(2009) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes

ASTM B43	(2009) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B584	(2011) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B75	(2002; R 2010) Standard Specification for Seamless Copper Tube
ASTM B813	(2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B828	(2002; R 2010) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2005; R 2011) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C1053	(2000; R 2010) Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C564	(2011) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2235	(2004; R 2011) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2239	(2003) Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2004; R 2009e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2661	(2011) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40, Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2665	(2011) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2672	(1996a; R 2009) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D2683	(2010) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2737	(2003) Polyethylene (PE) Plastic Tubing
ASTM D2822/D2822M	(2005e1; R 2011) Asphalt Roof Cement
ASTM D2846/D2846M	(2009be1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2855	(1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D2996	(2001; R 2007e1) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3035	(2010) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3122	(1995; R 2009) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D3138	(2004; R 2011) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3261	(2010a) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM E1	(2007) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM F 1760	(2001; R 2011) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 2389	(2010) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
ASTM F 409	(2002; R 2008) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(2009) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(2009) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(2011) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(2010) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2008) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core

ASTM F 877	(2011a) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F 891	(2010) Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2009) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(1994; R 1995) Copper Tube Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO PS 117	(2005b) Press Type Or Plain End Rub Gasketed W/ Nail CU & CU Alloy Fittings 4 Install On CU Tubing

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(2009) International Plumbing Code
ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(2010; Errata 2011) Steel Pipeline Flanges
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2002a) Butterfly Valves
MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MSS SP-70	(2006) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(2010) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(2005a) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2006) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-85	(2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE SP0169	(1992; R 2007) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2009) Motors and Generators
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF/ANSI 14	(2011a) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2011) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2010) Firestopping: Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(2010) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508 (2009) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SM 9223 (2004) Enzyme Substrate Coliform Test

PL 93-523 (1974; A 1999) Safe Drinking Water Act

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED (2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 141.80 National Primary Drinking Water Regulations; Control of Lead and Copper; General Requirements

PL 109-58 Energy Policy Act of 2005 (EPAct05)

UNDERWRITERS LABORATORIES (UL)

UL 1951 (2011) Electric Plumbing Accessories

UL 499 (2005; Reprint Mar 2011) Electric Heating Appliances

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 - SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System;

Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-03 Product Data

Fixtures

Flush valve water closets

Flush valve urinals

Wall hung lavatories

Kitchen sinks

Utility sinks

Floor sinks

Drinking-water coolers

Water heaters

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies;

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests.

SD-10 Operation and Maintenance Data

Plumbing System

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000

hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.3 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.4 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.3.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - IP

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system.

1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. PVC pipe shall contain a minimum of 25 percent recycled content in accordance with ASTM F 1760. HDPE pipe shall contain a minimum of 100 percent post-consumer recycled content. Steel pipe shall contain a minimum of 25 percent recycled content, with a minimum of 16 percent post-consumer recycled content. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F 2389. Polypropylene piping

that will be exposed to UV light shall be provided with a Factory applied UV resistant coating. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310

b. Coupling for Steel Pipe: AWWA C606.

c. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12).

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

g. Solder Material: Solder metal shall conform to ASTM B32.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.

k. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 230 degrees F.

l. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F 477.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138.

o. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D2235.

p. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.

q. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

r. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

s. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D3122.

t. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

u. Copper tubing shall conform to ASTM B88, Type K, L or M.

v. Heat-fusion joints for polypropylene piping: ASTM F 2389.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201. Water hammer arrester shall be piston type.

b. Copper, Sheet and Strip for Building Construction: ASTM B370.

c. Asphalt Roof Cement: ASTM D2822/D2822M.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

l. Thermometers: ASTM E1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110

Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Wall Hydrants (Frostproof)

ASSE 1019 with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

2.3.4 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve.The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets.The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.5 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1. Vitreous China, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with

appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains shall be copper alloy with all visible surfaces chrome plated. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature.

2.4.1 Automatic Controls

Provide automatic, sensor operated faucets and flush valves to comply with ASSE 1037 and UL 1951 for lavatory faucets, urinals, and water closets. Flushing and faucet systems shall consist of solenoid-activated valves with light beam sensors. Flush valve for water closet shall include an override pushbutton. Flushing devices shall be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

2.4.2 Flush Valve Water Closets

ASME A112.19.2/CSA B45.1, white vitreous china, siphon jet, elongated bowl, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 14 to 15 inches, except 17 to 19 inches for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Provide white solid plastic elongated open-front seat.

Water flushing volume of the water closet and flush valve combination shall not exceed1.28 gallons per flush.

Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Mounted height of flush valve shall not interfere with the hand rail in ADA stalls. Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.

2.4.3 Flush Valve Urinals

ASME A112.19.2/CSA B45.1, white vitreous china, wall-mounted, wall outlet, siphon jet, integral trap, and extended side shields. Provide urinal with the rim 17 inches above the floor. Water flushing volume of the urinal and flush valve combination shall not exceed 0.125 gallons per flush. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.

2.4.4 Wall Hung Lavatories

ASME A112.19.2/CSA B45.1, white vitreous china, straight back type, minimum dimensions of 19 inches, wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory. Mount lavatory with the front rim 34 inches above floor and with 29 inches minimum clearance from bottom of the front rim to floor. Provide top mounted washerless centerset lavatory faucets. Provide top-mounted solenoid-activated lavatory faucets including electrical-operated light-beam-sensor to energize the solenoid.

2.4.5 Kitchen Sinks

ASME A112.19.3/CSA B45.4, 20 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of 33 inches wide by 21 inches front to rear, two compartments, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 3.5 inch drain outlet. Provide aerator with faucet. Water flow rate shall not exceed 1.0 gpm when measured at a flowing water pressure of 60 psi. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 1.5 inch P-trap and drain piping to vertical vent piping from each compartment. Provide top mounted washerless sink faucets with hose spray.

2.4.6 Utility Sinks

ASME A112.19.2/CSA B45.1, white vitreous china with integral back and wall hanger supports, minimum dimensions of 22 inches wide by 20 inches front to rear, with two supply openings in 10 inch high back. Provide floor supported wall outlet cast iron P-trap and stainless steel rim guards as recommended by service sink manufacturer. Provide back mounted washerless service sink faucets with vacuum breaker and 0.75 inch external hose threads.

2.4.7 Drinking-Water Coolers

AHRI 1010 with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bubbler style, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor and basin, and stainless steel cabinet. Bubblers shall be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts shall be mounted at maximum of 36 inches above floor and at front of unit basin. Spouts shall direct water flow at least 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit. Provide ASME A112.6.1M concealed steel pipe chair carriers.

2.4.8 Wheelchair Drinking Water cooler

AHRI 1010, wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with 27 inch minimum knee clearance from front bottom of unit to floor and 36 inch maximum spout height above floor. Bubblers shall also be controlled by push levers, by

push bars, or touch pads one on each side or one on front and both sides of the cabinet.

2.5 DRAINS

2.5.1 Floor Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping. Primer shall meet ASSE 1018.

2.5.1.1 Drains and Backwater Valves

Drains and backwater valves installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.5.2 Floor Sinks

Floor sinks shall be square, with 12 inch nominal overall width or diameter and 10 inch nominal overall depth. Floor sink shall have an acid-resistant enamel interior finish with cast-iron body, aluminum sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size shall be as indicated or of the same size as the connecting pipe.

2.6 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The

assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.7 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 200 degrees F water temperature and 150 psi working pressure. The expansion tank size and acceptance volume shall be sized by the manufacturer.

2.7.1 Electric Instantaneous Water Heaters (Tankless)

UL 499 and UL listed flow switch activated, tankless electric instantaneous water heater for wall mounting below sink or lavatory.

2.8 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.9 MISCELLANEOUS PIPING ITEMS

2.9.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.9.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

2.9.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.9.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.9.3 Pipe Hangers (Supports)

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.9.4 Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using

crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.6 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise

location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Rigid grooved pipe couplings shall be for use with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 125 psi service and appropriate for static head plus the pumping head, and shall provide a watertight joint.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.1.2.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.2.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.6 Copper Tube and Pipe

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper- phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.

c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

d. Press connection. Copper press connections shall be made in **strict** accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer **of that joint**. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

3.1.2.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.2.8 Polypropylene Pipe

Joints for polypropylene pipe and fittings shall be made by heat fusion welding socket-type or butt-fusion type fittings and shall comply with ASTM F 2389.

3.1.2.9 Other Joint Methods

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be in accordance with industry standard. Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt

around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs,

flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve.The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.5.6 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.7.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 4 inches.

(2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in

determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 4 inches and larger carrying medium less that 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.7.3 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged

branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair

carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.4.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.4.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.4.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified inDIVISION 05 - METALS.

3.4 IDENTIFICATION SYSTEMS

3.4.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.4.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in DIVISION 09 - FINISHES.

3.4.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as directed by the Contracting Officer.

3.5 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.6 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in DIVISION 09 - FINISHES.

3.6.1 Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.6.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.6.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

3.7 TESTS, FLUSHING AND DISINFECTION

3.7.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.7.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.7.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.7.3 System Flushing

3.7.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with hot potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

3.7.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced.After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.7.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Temperature of each domestic hot-water supply.

f. Operation of each floor and roof drain by flooding with water.

g. Operation of each vacuum breaker and backflow preventer.

h. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

3.7.5 Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take addition samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with EPA SM 9223. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.8 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

3.9 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.10 TABLES

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X	

3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A536 And ASTM A47/A47M	X	X		X	X	
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M for use with Item 5	X	X		X	X	
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 5	X	X		X	X	
8	Wrought copper grooved joint pressure pressure fittings for non-ferrous pipe ASTM B75M ASTM B75 C12200, ASTM B152/B152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X				
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
10	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S, Grade B	X			X	X	

11	Seamless red brass pipe, ASTM B43				X	X	
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
13	Cast copper alloy solder joint pressure fittings, ASME B16.18for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B42						X
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D2661, ASTM F 628	X	X	X	X	X	X
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X	X	X
21	Process glass pipe and fittings, ASTM C1053						X

22	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A518/A518M		X			X	X
23	Polypropylene (PP) waste pipe and fittings, ASTM D4101						X
24	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D2996						X

SERVICE:
- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- * - Hard Temper

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	
4	Steel pipe:				

	a. Seamless, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings groovedjoint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter	X			X
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D3035	X			X

15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F 441/F 441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F 442/F 442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F 437, for use with Items 20, and 21	X	X		X
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F 438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F 439 for use with Items 20, 21, and 22	X	X		X

25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D1785	X			X
26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2467 for use with Items 26 and 27	X			X
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2464	X			X
30	Joints for IPS PVC pipe using solvent cement, ASTM D2672	X			X
31	Polypropylene (PP) plastic pipe and fittings; ASTM F 2389	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F 877	X	X		X

38	Press Fittings: A - Cold Water Service Aboveground B - Hot and Cold Water Distribution 82 degrees C 180 degrees F Maximum Aboveground C - Compressed Air Lubricated D - Cold Water Service Belowground Indicated types are minimum wall thicknesses. ** - Type L - Hard *** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors **** - In or under slab floors only brazed joints

-- End of Section --

SECTION 22 07 19.00 40

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 209	(2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1136	(2006) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 195	(2000) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C 553	(2002) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 795	(2003) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(2003a) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 579	(2004) Standard Specification for Greige Woven Glass Fabrics
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 96/E 96M	(2005) Standard Test Methods for Water Vapor Transmission of Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(2006) Standard on Types of Building Construction
NFPA 255	(2005; Errata 2006) Standard Method of Test of Surface Burning Characteristics of Building Materials

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3779	(1990; Rev A; R 1994) Tape Adhesive, Pressure Sensitive Thermal Radiation Resistant, Aluminum Foil/Glass Cloth

1.2 SYSTEM DESCRIPTION

Section 23 00 00.00 40 HEATING, VENTILATING, AND AIR-CONDITIONING applies to work specified in this section.

1.3 PERFORMANCE REQUIREMENTS

Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, shall have a flame-spread classification (FSC) of 25, and a smoke-developed classification (SDC) of 50. These maximum values shall be determined in accordance with ASTM E 84 or NFPA 255. Coatings and sealants shall be nonflammable in their wet state.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Adhesives
Coatings
Insulation Materials
Jacketing

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry

state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 Cloth Adhesives

Adhesives for adhering, sizing, and finishing lagging cloth, canvas, and open-weave glass cloth shall be a pigmented polyvinyl acetate emulsion and shall conform to the requirements of ASTM C 916, Type I.

2.1.1.2 Vapor-Barrier Material Adhesives

Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be solvent-base, synthetic-rubber type and shall conform to the requirements of ASTM C 916, Type I, for attaching fibrous-glass insulation to metal surfaces. Solvent shall be nonflammable.

2.1.1.3 Cellular Elastomer Insulation Adhesive

Adhesive for cellular elastomer insulation shall be a solvent cutback chloroprene elastomer conforming to ASTM C 916, Type I, and shall be of a type approved by the manufacturer of the cellular elastomer for the intended use.

2.1.2 Coatings

2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be a nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to the requirements of ASTM C 1136 and ASTM C 921.

2.1.2.2 Indoor Vapor-Barrier Finishing

Coatings for indoor vapor-barrier finishing of insulation surfaces shall be a pigmented resin and solvent compound and shall conform to ASTM C 1136, Type II.

2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer-emulsion type recommended by the insulation material manufacturer for the surface to be coated and shall be applied to specified dry-film thickness.

2.1.2.4 Cellular-Elastomer Insulation Coating

Finish coating for cellular-elastomer insulation shall be a polyvinylchloride lacquer approved by the manufacturer of the cellular elastomer.

2.1.2.5 Coating Color

Coating color shall be as specified by the Contracting Officer's Technical Representative.

2.1.3 Insulating Cement

2.1.3.1 General Purpose Insulating Cement

General purpose insulating cement shall be mineral fiber and shall conform to ASTM C 195. Composite shall be rated for 1800 degrees F service and shall have a thermal-conductivity maximum of 0.85<MET> [_____] watt per meter per degree Kelvin</MET> Btu by inch per hour per square foot for each degree F temperature differential at 200 degrees F mean temperature for 1 inch thickness.

2.1.3.2 Finishing Insulating Cement

Finishing insulating cement shall be mineral-fiber, hydraulic-setting type conforming to ASTM C 449/C 449M.

2.1.4 Calking

Calking used with specified insulation materials shall be an elastomeric joint sealant in accordance with ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.5 Corner Angles

Corner angle piping insulation shall be nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be in accordance with ASTM B 209, Alloy 3105.

2.1.6 Insulation Materials

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

2.1.6.1 Mineral Fiber

Mineral fiber shall conform to ASTM C 553,
shall be suitable for surface temperatures up to 370 degrees F, and shall be of not less than 4-pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot square per degree F at 150 degrees F mean.

2.1.6.2 Pipe Barrel

Pipe barrel insulation shall be Type II, Molded, Grade A or Type III, Precision V-Groove, Grade A for use at temperatures up to and including 1200 degrees F.

2.1.6.3 Pipe Fittings

Pipe fitting insulation shall be molded pipe fitting covering for use at temperatures up to and including 1200 degrees F.

2.1.6.4 Flexible Blankets

Flexible blankets shall be blankets and felts for use at temperatures up to and including 350 degrees F minimum 1 pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot per degree F at 75 degrees F mean.

2.1.6.5 Cellular Glass

Cellular glass shall conform to ASTM C 552, Type II, Grade 2, pipe covering. Substitutions for this material shall not be permitted. Minimum thickness shall be 1-1/2 inches

2.1.7 Jacketing

2.1.7.1 Glass Cloth Jackets

Glass cloth shall be plain-weave glass cloth conforming to ASTM D 579, Style 141 and shall weigh not less than 7.23 ounces per square yard before sizing. Cloth shall be factory applied wherever possible.

Glass reinforcing cloth shall be a leno weave, 26-end and 12-pick thread conservation, with a warp and fill tensile strength of 45 and 30 pounds per inch of width, respectively, and with a weight of not less than 1.5 ounces per square yard.

2.1.7.2 PVC Jackets

Polyvinylchloride (PVC) shall be a 0.010 inch thick, factory-premolded, pipe-barrel sheeting vapor-barrier jacketing. Material shall be self-extinguishing, high-impact strength, moderate chemical resistance. Permeability rating shall be 0.01 grain per hour per square foot per inch of mercury pressure difference, determined in accordance with ASTM E 96/E 96M. Vapor-barrier joint adhesive shall be the manufacturer's standard solvent-weld type.

Vapor barrier shall conform to ASTM C 1136, Type I, low-vapor transmission, high-puncture resistance for use on insulation for piping, ducts, and equipment.

2.1.7.3 3-Ply Laminate

Jacketing shall be a 3-ply laminate of 35-pound per 100 square foot white-bleached kraft, bonded to not less than 0.0007 inch thick aluminum foil and reinforced with glass fiber.

Water-vapor permeance rating of the composite shall be 0.02 perm or grain per hour per square foot, per inch of mercury pressure differential, determined in accordance with ASTM E 96/E 96M.

2.1.8 Tape

Glass lagging shall be a knitted elastic cloth specifically suitable for continuous spiral wrapping of insulated pipe bends and fittings and shall produce a smooth, tight, wrinkle-free surface. Tape shall conform to

requirements of SAE AMS 3779, SAE AMS 3779, ASTM D 579, and ASTM C 921, and shall weigh not less than 10 ounces per square yard.

2.2 PIPING SYSTEMS

Insulation thickness and pipe sizes are in inches. Pipe size is inclusive dimensionally, and includes pipe nominal pipe size (NPS) and tubing outside diameter.

2.2.1 Cold-Water and Condensate-Drain Piping

Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated

Insulation shall be 3/8 inch mineral fiber with glass cloth jacket, Type T-2.

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Joints shall be tight with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed, or finished as specified. Longitudinal seams of exposed insulation shall be directed away from normal view.

Materials shall be applied in conformance with the recommendations of the manufacturer.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

Installation Drawings for pipe insulation shall be in accordance with the adhesive manufacturer's written instructions for installation.

3.2 SYSTEM TYPES

3.2.1 Type T-1, Mineral Fiber with Vapor-Barrier Jacket

Piping shall be covered with mineral-fiber pipe insulation with factory-and field-attached vapor-barrier jacket. Vapor seal shall be maintained. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than 1-1/2 inches. Jacketing bands for butt joints shall be 3 inches wide.

Exposed-to-view fittings and valve bodies shall be covered with preformed mineral-fiber pipe-fitting insulation of the same thickness as the pipe-barrel insulation. Fitting insulation shall be temporarily secured in place

with light cord ties.A 60-mil coating of white indoor vapor-barrier coating shall be applied and, while still wet, wrapped with glass lagging tape with 50 percent overlap, and shall be smoothly blended into the adjacent jacketing. Additional coating shall be applied as needed and rubber-gloved to smooth fillet or contour coating, then allowed to fully cure before the finish coating is applied. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a special mastic consisting of a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Where standard vapor-barrier jacketing cannot be used, the surfaces shall be made vapor tight by using coating and glass lagging cloth or tape as previously specified.

In lieu of materials and methods previously specified, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. Seams shall be made vapor tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. All jacket ends shall be held in place with AISI 300 series corrosion-resistant steel straps, 15 mils thick by 1/2 inch wide.

Pipe insulation shall be set into an outdoor vapor-barrier coating for a minimum of 6 inches at maximum 12-foot spacing and the ends of the insulation sealed to the jacketing with the same material to provide an effective vapor-barrier stop.

Staples shall not be used in applying insulation. Vapor-barrier materials shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealments.

Piping insulation at hangers shall consist of 13-pounds per cubic foot density, fibrous-glass inserts or expanded, rigid, closed-cell, polyvinylchloride. Junctions shall be sealed with vapor-barrier jacket where required, glass-cloth mesh tape, and vapor-barrier coating.

White-bleached kraft paper side of the jacketing shall be on the side exposed to view.

Exposed-to-view insulation shall be finished with not less than a 6-mil dry-film thickness of nonvapor-barrier coating suitable for painting.

3.2.2 Type T-10, Mineral-Fiber Fill

Voids surrounding pipe shall be packed with mineral-fiber fill.

-- End of Section --

SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 201	(2002; R 2011) Fans and Systems
AMCA 210	(2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(2008) Reverberant Room Method for Sound Testing of Fans
AMCA 301	(2006; INT 2007; Errata 2008) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 260	(2001) Sound Rating of Ducted Air Moving and Conditioning Equipment
AHRI 350	(2008) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
AHRI 410	(2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI 430	(2009) Central-Station Air-Handling Units
AHRI 440	(2008) Room Fan-Coils and Unit Ventilators
AHRI 880	(2011) Performance Rating of Air Terminals
AHRI 885	(2011) Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
AHRI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11	(1990; R 2008) Load Ratings and Fatigue Life for Roller Bearings
ABMA 9	(1990; R 2008) Load Ratings and Fatigue Life for Ball Bearings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.2	(2007; Addenda B 2008; Errata 2009, Errata 2010; INT 2010; Errata 2011) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 62.1	(2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality
ASHRAE 68	(1997) Laboratory Method of Testing to Determine the Sound Power In a Duct
ASHRAE 70	(2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B766	(1986; R 2008) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C1071	(2005e1) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

ASTM C553	(2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM D1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D3359	(2009e2) Measuring Adhesion by Tape Test
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM E2016	(2006) Standard Specification for Industrial Woven Wire Cloth
ASTM E84	(2011b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F 1040	(1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2009) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code
NFPA 701	(2010) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1819	(2002) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 5th Edition
SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82	Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 181	(2005; Reprint Oct 2008) Factory-Made Air Ducts and Air Connectors
UL 1995	(2011) Heating and Cooling Equipment
UL 555	(2006; Reprint Sep 2011) Standard for Fire Dampers
UL 555S	(1999; Reprint May 2011) Smoke Dampers
UL 586	(2009) Standard for High-Efficiency Particulate, Air Filter Units
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 705	(2004; Reprint Apr 2011) Standard for Power Ventilators
UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
UL 900	(2004; Reprint Nov 2009) Standard for Air Filter Units
UL 94	(1996; Reprint Oct 2010) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL Bld Mat Dir	(2011) Building Materials Directory
UL Electrical Construction	(2011) Electrical Construction Equipment Directory
UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

1.2.1 Mechanical Equipment Identification

The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms. Where more than one chart or diagram per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.2.1.1 Charts

Provide chart listing of equipment by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics.

1.2.1.2 Diagrams

Submit proposed diagrams, at least 2 weeks prior to start of related testing. provide neat mechanical drawings provided with extruded aluminum frame under 1/8-inch glass or laminated plastic, system diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system. After approval, post these items where directed.

1.2.2 Service Labeling

Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation.

1.2.3 Color Coding

Color coding of all piping systems shall be in accordance with ASME A13.1.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings;

SD-03 Product Data

Metallic Flexible Duct
Insulated Nonmetallic Flexible Duct Runouts
Duct Connectors
Duct Access Doors
Fire Dampers
Manual Balancing Dampers
Automatic Smoke Dampers
Diffusers
Registers and Grilles
Louvers
In-Line Centrifugal Fans
Sidewall Propeller Type Fans
Centrifugal Type Power Roof Ventilators
Air Handling Units
Room Fan-Coil Units
Variable Volume, Single Duct Terminal Units
Test Procedures
Diagrams

SD-06 Test Reports

Performance Tests

SD-07 Certificates

None

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions
Operation and Maintenance Training

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Fire Dampers
Automatic Smoke Dampers
In-Line Centrifugal Fan
Sidewall Propeller Type Fans
Centrifugal Type Power Roof Ventilators
Air Handling Units
Room Fan-Coil Units
Variable Volume, Single Duct Terminal Units

1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.

c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or

treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations. Provide written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. Include illustrations of product markings, and the number of each type of bolt to be furnished in the certification.

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 Ozone Depleting Substances Used as Refrigerants

Minimize releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F.

1.4.4 Use of Ozone Depleting Substances, Other than Refrigerants

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

a. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon

b. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays.

c. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial cabling.

d. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

1.4.5 Detail Drawings

Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of

the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

1.4.6 Test Procedures

Submit proposed test procedures and test schedules for the ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

2.2 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

2.3 ELECTRICAL WORK

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00INTERIOR DISTRIBUTION SYSTEM. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.

c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system , and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.

d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

e. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers are allowed to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and adjustable frequency drives for larger motors.

2.4 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

2.5 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

2.6 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

2.7 DUCT SYSTEMS

2.7.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification.

a. Ductwork shall be constructed meeting the requirements for the duct system static pressure specified in APPENDIX D of Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

b. Provide ductwork that meets the requirements of Seal Class A. Provide ductwork in VAV systems upstream of the VAV boxes that meets the requirements of Seal Class A.

c. Provide sealants that conform to fire hazard classification specified in DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.

2.7.1.1 Metallic Flexible Duct

a. Provide duct that conforms to UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Provide duct assembly that does not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of two inches water gauge positive and 1.5 inches water gauge negative. Provide flexible round duct length that does not exceed five feet. Secure connections by applying adhesive for two inches over rigid duct, apply flexible duct two inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.

b. Inner duct core: Provide interlocking spiral or helically corrugated flexible core constructed of zinc-coated steel, aluminum, or stainless steel; or constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.

c. Insulation: Provide inner duct core that is insulated with mineral fiber blanket type flexible insulation, minimum of one inch thick. Provide insulation covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

2.7.1.2 Insulated Nonmetallic Flexible Duct Runouts

Use flexible duct runouts only where indicated.Runout length is indicated on the drawings, and is not to exceed 5 feet. Provide runouts that are preinsulated, factory fabricated, and that comply with NFPA 90A and UL 181. Provide either field or factory applied vapor barrier. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts.Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

2.7.1.3 General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector

system that complies with NFPA 701 and is classified as "flame-retardent fabrics" in UL Bld Mat Dir.

2.7.2 Duct Access Doors

Provide hinged access doors conforming to SMACNA 1966 in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 15 by 18 inches, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 24 by 24 inches or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

2.7.3 Fire Dampers

Use 1.5 hour rated fire dampers unless otherwise indicated. Provide fire dampers that conform to the requirements of NFPA 90A and UL 555. Perform the fire damper test as outlined in NFPA 90A. Provide a pressure relief door upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then provide a factory installed pressure relief damper. Provide automatic operating fire dampers with a dynamic rating suitable for the maximum air velocity and pressure differential to which it is subjected. Provide fire dampers approved for the specific application, and install according to their listing. Equip fire dampers with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, does not impair the operation of the damper. Equip sleeves or frames with perimeter mounting angles attached on both sides of the wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies in conformance with UL Fire Resistance. Provide curtain type with damper blades out of the air stream or single blade type or multi-blade type fire dampers. Install dampers that do not reduce the duct or the air transfer opening cross-sectional area. Install dampers so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, comply with the installation details given in SMACNA 1819 and in manufacturer's instructions for fire dampers. Perform acceptance testing of fire dampers according to paragraph Fire Damper Acceptance Test and NFPA 90A.

2.7.4 Manual Balancing Dampers

a. Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators.

b. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide access doors or panels in hard ceilings, partitions and walls for access to all concealed damper operators and damper locking setscrews. Coordinate location of doors or panels with other affected contractors.

c. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.7.4.1 Square or Rectangular Dampers

a. Duct Height 12 inches and Less

(1) Frames:
Maximum 19 inches in width, maximum 12 inches in height; minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height; Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

(2) Single Leaf Blades:
Maximum 19 inches in width, maximum 12 inches in height; Minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height; Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

(3) Blade Axles:
To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

Maximum 19 inches in width, maximum 12 inches in height; Galvanized steel, minimum of 3/8 inch square shaft.

More than 19 inches in width, maximum 12 inches in height; Galvanized steel, minimum of 1/2 inch square shaft.

(4) Axle Bearings:
Support the shaft on each end at the frames with shaft bearings. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

Maximum 19 inches in width, maximum 12 inches in height; solid nylon, or equivalent solid plastic, or oil-impregnated bronze bearings.

More than19 inches in width, maximum 12 inches in height; oil-impregnated bronze bearings.

(5) Control Shaft/Hand Quadrant:
Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 50 mm 2 inches off the metal duct surface. Stand-off mounting items

shall be integral with the operator or standard accessory of the damper manufacturer.

(6) Finish: Mill Galvanized

b. Duct Height Greater than 12 inches

Provide dampers with multi-leaf opposed-type blades.

(1) Frames:
Maximum 48 inches in height; maximum48 inches in width; minimum of 16 gauge galvanized steel,
minimum of 5.5 inches long.

(2) Blades:
Minimum of 16 gauge galvanized steel; 6 inch nominal width.

(3) Blade Axles:
To support the blades of round dampers, provide galvanized square steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

(4) Axle Bearings:
Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

(5) Blade Actuator: Minimum 1/2 inch diameter galvanized steel.

(6) Blade Actuator Linkage: Mill Galvanized steel bar and crank plate with stainless steel pivots.

(7) Control Shaft/Hand Quadrant: Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 50 mm 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

(8) Finish: Mill Galvanized

2.7.4.2 Round Dampers

a. Frames:

4 to 20 inches size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

22 to 30 inches size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

32 to 40 inches size: Minimum of 16 gauge galvanized steel, minimum of 10 inches long.

b. Blades:

4 to 20 inches size: Minimum of 20 gauge galvanized steel

22 to 30 inches size: Minimum of 16 gauge galvanized steel

32 to 40 inches size: Minimum of 10 gauge galvanized steel

c. Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

4 to 20 inches size: Minimum of 3/8 inch square shaft.

22 to 30 inches size: Minimum of 1/2 inch square shaft.

32 to 40 inches size: Minimum of 3/4 inch square shaft.

d. Axle Bearings:

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

4 to 20 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

22 to 30 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

32 to 40 inches size: oil-impregnated bronze, or stainless steel sleeve bearing

e. Control Shaft/Hand Quadrant:

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

f. Finish: Mill Galvanized

2.7.5 Automatic Balancing Dampers

Provide dampers as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.7.6 Automatic Smoke Dampers

UL listed multiple blade type, supplied by smoke damper manufacturer, with pneumatic damper operator as part of assembly. Qualified under UL 555S with a leakage rating no higher than Class II or III at an elevated temperature Category B (250 degrees F for 30 minutes). Ensure that pressure drop in the damper open position does not exceed 0.1 inch water gauge with average duct velocities of 2500 fpm.

2.7.7 Diffusers, Registers, and Grilles

Provide factory-fabricated units of steel that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to ASHRAE 70.Provide sound rated and certified inlets and outlets according to ASHRAE 70.Provide sound power level as indicated. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers, except linear slot diffusers. Provide linear slot diffusers with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, protect them by a grille or screen according to NFPA 90A.

2.7.7.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Provide diffusers with air deflectors of the type indicated. Provide air handling troffers or combination light and ceiling diffusers conforming to the requirements of UL Electrical Construction for the interchangeable use as cooled or heated air supply diffusers or return air units. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

2.7.7.2 Registers and Grilles

Provide units that are four-way directional-control type, except provide return and exhaust registers that are fixed horizontal or vertical louver type similar in appearance to the supply register face. Furnish registers with sponge-rubber gasket between flanges and wall or ceiling. Install wall supply registers at least 6 inches below the ceiling unless otherwise indicated. Locate return and exhaust registers 6 inches above the floor unless otherwise indicated. Achieve four-way directional control by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Provide grilles as specified for registers, without volume control damper.

2.7.8 Louvers

Provide louvers for installation in exterior walls that are associated with the air supply and distribution system as specified in Section 08 91 00 METAL WALL LOUVERS.

2.7.9 Bird Screens and Frames

Provide bird screens that conform to ASTM E2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.8 AIR SYSTEMS EQUIPMENT

2.8.1 Fans

Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans shall not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 150 percent of the connected driving capacity. Provide variable pitch motor sheaves for 15 hp and below, and fixed pitch as defined by AHRI Guideline D (A fixed-pitch sheave is provided on both the fan shaft and the motor shaft. This is a non-adjustable speed drive.). Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to AMCA 300. Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to UL 705 and have a UL label.

2.8.1.1 In-Line Centrifugal Fans

Provide in-line fans with centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Mount fans in a welded tubular casing. Provide a fan that axially flows the air in and out. Streamline inlets with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Enclose and isolate fan bearings and drive shafts from the air stream. Provide precision, self aligning ball or roller type fan bearings that are sealed against dust and dirt and are permanently lubricated. Provide L50 rated bearing life at not less than 200,000 hours as defined by

ABMA 9 and ABMA 11. Provide motors with totally enclosed enclosure. Provide manual motor starters across-the-line with general-purpose enclosures.

2.8.1.2 Sidewall Propeller Type Fans

Provide propeller type fans, assembled on a reinforced metal panel with venturi opening spun into panel. Provide direct or V-belt driven fans with wheels less than 24 inches in diameter and provide V-belt driven fans with wheels 24 inches in diameter and larger. Provide fans with wall mounting collar. Provide lubricated bearings. Equip fans with wall housing kits. Provide totally enclosed fan cooled type motor enclosure. Install gravity backdraft dampers where indicated. Provide with accessories as indicates on the plans.

2.8.1.3 Centrifugal Type Power Roof Ventilators

Provide direct or V-belt driven centrifugal type fans with backward inclined, non-overloading wheel. Provide hinged or removable and weatherproof motor compartment housing, constructed of heavy gauge aluminum. Provide fans with birdscreen, disconnect switch as indicated, gravity dampers, and roof curb. Provide dripproof type motor enclosure. Use only lubricated bearings.

2.8.2 Coils

Provide fin-and-tube type coils constructed of seamless copper tubes and aluminum fins mechanically bonded or soldered to the tubes. Provide copper tube wall thickness that is a minimum of 0.016 inches. Provide aluminum fins that are 0.0055 inch minimum thickness. Provide casing and tube support sheets that are not lighter than 16 gauge galvanized steel, formed to provide structural strength.When required, provide multiple tube supports to prevent tube sag. Test each coil at the factory under water at not less than 400 psi air pressure and make suitable for 200 psi working pressure and 300 degrees F operating temperature unless otherwise stated. Mount coils for counterflow service. Rate and certify coils to meet the requirements of AHRI 410.

2.8.2.1 Electric Heating Coil

Provide an electric duct heater coil in accordance with UL 1995 and NFPA 70. Provide duct- or unit-mounted coil. Provide nickel chromium resistor, single stage, strip type coil. Provide coil with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized. Provide galvanized steel or aluminum coil casing and support brackets. Mount coil to eliminate noise from expansion and contraction and for complete accessibility for service.

2.8.3 Air Filters

List air filters according to requirements of UL 900, except list high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method under the Label Service to meet the requirements of UL 586.

2.8.3.1 Extended Surface Pleated Panel Filters

Provide 2 inch depth, sectional, disposable type filters of the size indicated with a MERV of 8 when tested according to ASHRAE 52.2. Provide

initial resistance at 500 fpm that does not exceed 0.36 inches water gauge. Provide UL Class 2 filters, and nonwoven cotton and synthetic fiber mat media. Attach a wire support grid bonded to the media to a moisture resistant fiberboard frame. Bond all four edges of the filter media to the inside of the frame to prevent air bypass and increase rigidity.

2.8.3.2 Extended Surface Nonsupported Pocket Filters

Provide 4 inch depth, sectional, replaceable dry media type filters of the size indicated with a MERV of 13 when tested according to ASHRAE 52.2. Provide initial resistance at 500 fpm that does not exceed 0.45 inches water gauge. Provide UL Class 1 filters. Provide fibrous glass media, supported in the air stream by a wire or non-woven synthetic backing and secured to a galvanized steel metal header. Provide pockets that do not sag or flap at anticipated air flows. Install each filter with an extended surface pleated panel filter as a prefilter in a factory preassembled, side access housing or a factory-made sectional frame bank, as indicated.

2.8.3.3 Cartridge Type Filters

Provide 12 inch depth, sectional, replaceable dry media type filters of the size indicated with a MERV of 13 when tested according to ASHRAE 52.2. Provide initial resistance at 500 fpm that does not exceed 0.56 inches, water gauge. Provide UL class 1 filters, and pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow have no effect on filter integrity or performance. Install each filter with an extended surface pleated media panel filter as a prefilter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.8.3.4 Holding Frames

Fabricate frames from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Equip each holding frame with suitable filter holding devices. Provide gasketed holding frame seats. Make all joints airtight.

2.8.3.5 Filter Gauges

Provide dial type filter gauges, diaphragm actuated draft for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, with white dials with black figures, and graduations with a minimum range of 1 inch of water beyond the specified final resistance for the filter bank on which each gauge is applied. Provide each gauge with a screw operated zero adjustment and two static pressure tips with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

2.9 AIR HANDLING UNITS

2.9.1 Field-Fabricated Air Handling Units

Provide built-up units as specified in paragraph DUCT SYSTEMS. Provide fans, coils spray-coil dehumidifiers, and air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types indicated.

2.9.2 Factory-Fabricated Air Handling Units

Provide single-zone draw-through type or single-zone blow-through type units as indicated. Units shall include fans, coils, airtight insulated casing, filter sections, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, mixing box, spray type humidifier, vibration-isolators, and appurtenances required for specified operation. Provide vibration isolators as indicated. Physical dimensions of each air handling unit shall be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling.

2.9.2.1 Casings

Provide the following:

a. Casing sections 2 inch double wall type as indicated, constructed of a minimum 18 gauge galvanized steel, or 18 gauge corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Inner casing of double-wall units that are a minimum 20 gauge solid galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.

b. Individually removable exterior panels with standard tools. Removal shall not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.

c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 18 gauge outer and 20 gauge inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be a minimum 24 inches wide, the full height of the unit casing or a minimum of 6 foot, whichever is less.

d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 16 gauge galvanized steel, conforming to ASHRAE 62.1. Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Coils shall be individually removable from the casing.

e. Casing insulation that conforms to NFPA 90A. Single-wall casing sections handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having

a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Double-wall casing sections handling conditioned air shall be insulated with not less than 2 inches of the same insulation specified for single-wall casings. Foil-faced insulation is not an acceptable substitute for use with double wall casing. Double wall insulation shall be completely sealed by inner and outer panels.

f. Factory applied fibrous glass insulation that conforms to ASTM C1071, except that the minimum thickness and density requirements do not apply, and that meets the requirements of NFPA 90A. Make air handling unit casing insulation uniform over the entire casing. Foil-faced insulation is not an acceptable substitute for use on double-wall access doors and inspections doors and casing sections.

g. Duct liner material, coating, and adhesive that conforms to fire-hazard requirements specified in DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING. Protect exposed insulation edges and joints where insulation panels are butted with a metal nosing strip or coat to meet erosion resistance requirements of ASTM C1071.

h. A latched and hinged inspection door, in the fan and coil sections. Plus additional inspection doors, access doors and access sections.

2.9.2.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

2.9.2.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.9.2.4 Fans

Provide the following:

a. Fans that are double-inlet, centrifugal type with each fan in a separate scroll. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the entire fan assembly. Mount fans on steel shafts, accurately ground and finished.

b. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11.Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.

c. Fans that are driven by a unit-mounted, or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Furnish belt guards that are the three-sided enclosed type with solid or expanded metal face. Belt drives

shall be designed for not less than a 1.3 service factor based on motor nameplate rating.

d. Motor sheaves that are variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by AHRI Guideline D. Where fixed sheaves are required, the use of variable pitch sheaves is allowed during air balance, but replace them with an appropriate fixed sheave after air balance is completed. Select variable pitch sheaves to drive the fan at a speed that produces the specified capacity when set at the approximate midpoint of the sheave adjustment. Furnish motors for V-belt drives with adjustable bases, and with open enclosures.

e. Motor starters of manual type with general-purpose enclosure. Select unit fan or fans to produce the required capacity at the fan static pressure with sound power level as indicated. Obtain the sound power level values according to AMCA 300, ASHRAE 68, or AHRI 260.

2.9.2.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

2.10 TERMINAL UNITS

2.10.1 Room Fan-Coil Units

Provide base units that include galvanized coil casing, coil assembly drain pan outside air damper, air filter, fans, motor, fan drive, motor switch, an enclosure for cabinet models and casing for concealed models, leveling devices integral with the unit for vertical type units, and sound power levels as indicated. Obtain sound power level data or values for these units according to test procedures based on AHRI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models are acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.Fasten each unit securely to the building structure. Provide units with capacity indicated. Provide room fan-coil units that are certified as complying with AHRI 440, and meet the requirements of UL 1995.

2.10.1.1 Enclosures

Fabricate enclosures from not lighter than 18 gauge steel, reinforced and braced. Provide enclosures with front panels that are removable and have 1/4 inch closed cell insulation or 1/2 inch thick dual density foil faced fibrous glass insulation. Make the exposed side of a high density, erosion-proof material suitable for use in air streams with velocities up to 4,500 fpm. Provide a discharge grille that is adjustable and that is of such design as to properly distribute air throughout the conditioned space. Plastic discharge and return grilles are acceptable provided the plastic material is certified by the manufacturer to be classified as flame resistant according to UL 94 and the material complies with the heat

deflection criteria specified in UL 1995. Provide galvanized or factory finished ferrous metal surfaces with corrosion resistant enamel, and access doors or removable panels for piping and control compartments, plus easy access for filter replacement. Provide duct discharge collar for concealed models.

2.10.1.2 Fans

Provide steel or aluminum, multiblade, centrifugal type fans. In lieu of metal, fans and scrolls could be of non-metallic materials of suitably reinforced compounds with smooth surfaces. Dynamically and statically balance the fans. Provide accessible assemblies for maintenance. Disassemble and re-assemble by means of mechanical fastening devices and not by epoxies or cements.

2.10.1.3 Coils

Fabricate coils from not less than 3/8 inch outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Provide coils with not less than 1/2 inch outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Test coils hydrostatically at 300 psi or under water at 250 psi air pressure. Provide coils suitable for 200 psi working pressure. Make provisions for coil removal.

2.10.1.4 Drain Pans

Size and locate drain and drip pans to collect all water condensed on and dripping from any item within the unit enclosure or casing. Provide condensate drain pans designed for self-drainage to preclude the buildup of microbial slime and thermally insulated to prevent condensation and constructed of not lighter than 21 gauge type 304 stainless steel or noncorrosive ABS plastic. Provide insulation with a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and of a waterproof type or coated with a waterproofing material. Design drain pans so as to allow no standing water and pitch to drain. Provide minimum 3/4 inch NPT or 5/8 inch OD drain connection in drain pan. Provide plastic or metal auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages; if metal, provide auxiliary pans that comply with the requirements specified above. Extend insulation at control and piping connections 1 inch minimum over the auxiliary drain pan.

2.10.1.5 Manually Operated Outside Air Dampers

Provide manually operated outside air dampers according to the arrangement indicated, and parallel airfoil type dampers of galvanized construction. Provide blades that rotate on stainless steel or nylon sleeve bearings.

2.10.1.6 Filters

Provide filters of the fiberglass disposable type, 1 inch thick, conforming to ASTM F 1040. Filters in each unit shall be removable without the use of tools.

2.10.1.7 Motors

Provide motors of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Provide motors with permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Provide a motor power consumption, shown in watts, at the fan operating speed selected to meet the specified capacity that does not exceed the following values:

Free Discharge Motors			
Unit Capacity (L/S) (cfm)	Maximum Power Consumption (Watts)		
	115V	230V	277V
94200	70	110	90
142300	100	110	110
189400	170	150	150
283600	180	210	220
378800	240	240	230
4721000	310	250	270
5661200	440	400	440

High Static Motors	
Unit Capacity (L/S) (cfm)	Maximum Power Consumption (Watts)
94200	145
142300	145
189400	210
283600	320
378800	320
4721000	530
5661200	530

2.10.2 Variable Air Volume (VAV) Units

a. Provide VAV units that are the type, size, and capacity shown, mounted in the ceiling or wall cavity, plus units that are suitable for single duct system applications. Provide actuators and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. For each VAV terminal unit, provide a temperature sensor in the unit discharge ductwork.

b. Provide unit enclosures that are constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Provide single or multiple discharge outlets as required. Units with flow limiters are not acceptable. Provide unit air volume that is factory preset and readily field adjustable without special tools.

c. Attach a flow chart to each unit. Base acoustic performance of the terminal units upon units tested according to AHRI 880 with the calculations prepared in accordance with AHRI 885. Provide sound power level as indicated. Show discharge sound power for minimum and 1-1/2 inches water gauge inlet static pressure. Provide acoustical lining according to NFPA 90A.

2.10.2.1 Variable Volume, Single Duct Terminal Units

Provide variable volume, single duct, terminal units with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Provide units that control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Provide units with an internal resistance not exceeding 0.4 inch water gauge at maximum flow range. Provide external differential pressure taps separate from the control pressure taps for air flow measurement with a 0 to 1 inch water gauge range.

2.11 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A123/A123M or ASTM A924/A924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B117, ASTM D1654, and ASTM D3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D520 Type I.

Factory painting that has been damaged prior to acceptance by the Contracting Officer shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.12 SUPPLEMENTAL COMPONENTS/SERVICES

2.12.1 Refrigerant Piping

The requirements for refrigerant piping are specified in Section 23 23 00 REFRIGERANT PIPING.

2.12.2 Condensate Drain Lines

Provide and install condensate drainage for each item of equipment that generates condensate in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.12.3 Backflow Preventers

The requirements for backflow preventers are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.12.4 Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.12.5 Controls

The requirements for controls are specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS and Section 23 09 23.13 20 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of 3 feet. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices)and an additional 3 feet.

c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

3.2.1 Condensate Drain Lines

Provide water seals in the condensate drain from all units room . Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2.2 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS. Provide concrete for foundations as specified in DIVISION 03 - CONCRETE.

3.2.3 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced. Provide access panels as specified in DIVISION 05 - METALS.

3.2.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

3.2.5 Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

3.2.6 Acoustical Duct Lining

Apply lining in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C916, Type I, NFPA 90A, UL 723, and ASTM E84. Provide top and bottom pieces that lap the side pieces and are secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA 1966. Provide welded pins, cup-head pins, or adhered clips that do not distort the duct, burn through, nor mar the finish or the surface of the duct. Make pins and washers flush with the surfaces of the duct liner and seal all breaks and punctures of the duct liner coating with the nonflammable, fire resistant adhesive. Coat exposed edges of the liner at the duct ends and at other joints where the lining is subject to erosion with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Apply duct liner to flat sheet metal prior to forming duct through the sheet metal brake. Additionally secure lining at the top and bottom surfaces of the duct by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA 1966 to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, are acceptable.

3.2.7 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

3.2.8 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit.

3.2.9 Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.2.10 Power Roof Ventilator Mounting

Provide foamed 1/2 inch thick, closed-cell, flexible elastomer insulation to cover width of roof curb mounting flange. Where wood nailers are used, predrill holes for fasteners.

3.2.11 Power Transmission Components Adjustment

Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.3 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 28 calendar days before being loaded.

3.4 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.5 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks.

3.6 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

a. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 20.

b. Framed Prepared Openings: Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.

c. Insulation: Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.

d. Closure Collars: Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation.Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.

e. Firestopping: Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING.

3.7 FIELD PAINTING OF MECHANICAL EQUIPMENT

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 120 degrees F. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

a. Temperatures less than 120 degrees F: Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat to metal surfaces subject to temperatures less than 120 degrees F.

b. Temperatures between 120 and 400 degrees F: Apply two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of two mils to metal surfaces subject to temperatures between 120 and 400 degrees F.

c. Temperatures greater than 400 degrees F: Apply two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of two mils to metal surfaces subject to temperatures greater than 400 degrees F.

3.8 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.9 DUCTWORK LEAK TESTS

The requirements for ductwork leak tests are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.10 DAMPER ACCEPTANCE TEST

Submit the proposed schedule, at least 2 weeks prior to the start of test. Operate all fire dampers and smoke dampers under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Test each fire damper equipped with fusible link by having the fusible link cut in place. Test dynamic fire dampers with the air handling and distribution system running. Reset all fire dampers with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, install the damper so it is square and free from racking.

3.11 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.12 PERFORMANCE TESTS

After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general operating tests by an experienced engineer. Provide tests that cover a period of not less than 5 days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

Submit test reports for the ductwork leak test, and performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.13 CLEANING AND ADJUSTING

Inside of fan-coil units and air terminal units, thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and install new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Maintain system in this clean condition

until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer.Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.14 OPERATION AND MAINTENANCE

3.14.1 Operation and Maintenance Manuals

Submit two manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in DIVISION 01 - GENERAL REQUIREMENTS. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

3.14.2 Operation and Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of 8 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS) Indoor Advantage

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Certification

1.3 RELATED REQUIREMENTS

This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.4.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.4.4 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.4.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.4.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.4.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's

recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under DIVISION 26 - ELECTRICAL. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of DIVISION 26 - ELECTRICAL.

1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified by a task order, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

1.8 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be

in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

-- End of Section --

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(2002; 6th ed) National Standards for Total System Balance
AABC MN-4	(1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV	(2006) Procedural Standards for Measurements and Assessment of Sound and Vibration
NEBB PROCEDURAL STANDARDS	(2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1143	(1985) HVAC Air Duct Leakage Test Manual, 1st Edition
SMACNA 1780	(2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition
SMACNA 1858	(2004) HVAC Sound And Vibration Manual - First Edition

1.2 DEFINITIONS

a. AABC: Associated Air Balance Council.

b. COR: Contracting Officer's Technical Representative.

c. DALT: Duct air leakage test

d. DALT'd: Duct air leakage tested

e. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.

f. NEBB: National Environmental Balancing Bureau

g. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING." When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."

h. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.

i. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.

j. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.

k. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).

l. TAB: Testing, adjusting, and balancing (of HVAC systems).

m. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.

n. TAB Agency: TAB Firm

o. TAB team field leader: TAB team field leader

p. TAB team supervisor: TAB team engineer.

q. TAB team technicians: TAB team assistants.

r. TABB: Testing Adjusting and Balancing Bureau.

1.2.1 Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems	International Standards for Environmental Systems Balance
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures	Field Readiness Check & Prelim. Field Procedures

1.3 WORK DESCRIPTION

The work includes duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air distribution systems including ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.2 Related Requirements

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Specific requirements related to Reliability Centered Maintenance (RCM) principles and Predictive Testing and Inspection (PTI), by the construction Contractor to detect latent manufacturing and installation defects must be followed as part of the Contractor's Quality Control program. Refer to the paragraph titled, Sustainability, for detailed requirements.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Pre-Final DALT report;

Final DALT report;
DALT and TAB Work Execution Schedule;

DALT and TAB Procedures Summary;

Design review report;

TAB report;

SD-07 Certificates

Prerequisite HVAC Work Check Out List;

Advanced notice for TAB field work;

Independent TAB agency and personnel qualifications;

Advance notice of Pre-Final DALT field work;

Completed Pre-Final DALT Work Checklist;

Advance Notice of TAB Field Work;

Completed Pre-TAB Work Checklist;

DALT and TAB Submittal and Work Schedule;

Design review report;

Pre-field DALT preliminary notification;

Pre-field TAB engineering report;

1.5 QUALITY ASSURANCE

1.5.1 Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Contracting Officer for approval:

a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.

c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.6 SEQUENCING AND SCHEDULING

1.6.1 DALT and TAB Submittal and Work Schedule

Comply with additional requirements specified in Appendix C: DALT AND TAB SUBMITTAL AND WORK SCHEDULE included at the end of this section

1.6.2 DALT and TAB Submittal and Work Schedule

Submit this schedule, and TAB Schematic Drawings, adapted for the particular project, to the Contracting Officer (CO) for review and approval. Include with the submittal the planned calendar dates for each submittal or work item.

1.6.2.1 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.6.2.2 Pre-Field DALT Preliminary Notification

Notification: On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing within 7 calendar days after completion.

1.6.2.3 Pre-Field TAB Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

(1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.

(2) Air System Diagrams: Use the contract drawings and duct fabrication drawings if available to provide air system diagrams in the report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagrams which identifies each outlet contained in the outlet airflow report sheets. Show intended locations of all traverses and static pressure readings.

(3) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or SMACNA 1780 data report forms with the following pre-field information filled in:

(1) Design data obtained from system drawings, specifications, and approved submittals.

(2) Notations detailing additional data to be obtained from the contract site by the TAB field team.

(3) Designate the actual data to be measured in the TAB field work.

(4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. Place the instrument key number in the blank space where the measured data would be entered.

c. Prerequisite HVAC work checkout list: Provide a list of inspections and work items which are to be completed by the Contractor. This list must be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.

At a minimum, a list of the applicable inspections and work items listed in the NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" must be provided for each separate system to be TAB'd.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section as specified in Appendix A WORK DESCRIPTIONS OF PARTICIPANTS.

3.2 PRE-DALT/TAB MEETING

Meet with the Contracting Officer's representative (COR) to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3 DALT PROCEDURES

3.3.1 Instruments, Consumables and Personnel

Provide instruments, consumables and personnel required to accomplish the DALT field work. Follow the same basic procedure specified below for TAB Field Work, including maintenance and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

3.3.2 Advance Notice of Pre-Final DALT Field Work

On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing prior to the COR's duct selection field visit.

3.3.3 Ductwork To Be DALT'd

From each duct system indicated as subject to DALT, the COR will randomly select sections of each completed duct system for testing by the Contractor's TAB Firm. The sections selected will not exceed 20 percent of the total measured linear footage of duct systems indicated as subject to DALT. Sections of duct systems subject to DALT will include 20 percent of main ducts, branch main ducts, branch ducts and plenums for supply, return, exhaust, and plenum ductwork.

It is acceptable for an entire duct system to be DALT'd instead of disassembling that system in order to DALT only the 20 percent portion specified above.

3.3.4 DALT Testing

Perform DALT on the HVAC duct sections of each system as selected by the COR. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in SMACNA 1143.

In spite of specifications of SMACNA 1143 to the contrary, DALT ductwork of construction class of 3-inch water gauge static pressure and below if indicated to be DALT'd. Complete DALT work on the COR selected ductwork within 48 hours after the particular ductwork was selected for DALT.

Separately conduct DALT work for large duct systems to enable the DALT work to be completed in 48 hours.

3.3.5 Pre-final DALT Report

After completion of the DALT work, prepare a Pre-final DALT Report meeting the additional requirements specified in Appendix B REPORTS - DALT and TAB. Data required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the Pre-final DALT report shall provide the basis for the Final DALT Report.

TAB supervisor shall review, approve and sign the Pre-Final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COR that the field check of the Pre-Final DALT Report data can commence.

3.3.6 Quality Assurance - COR DALT Field Acceptance Testing

In the presence of the COR and TAB team field leader, verify for accuracy Pre-final DALT Report data selected by the COR. For each duct system, this acceptance testing shall be conducted on a maximum of 50 percent of the duct sections DALT'd.

Further, if any data on the Pre-final DALT report form for a given duct section is out-of-tolerance, then field acceptance testing shall be conducted on data for one additional duct section, preferably in the same duct system, in the presence of the COR.

3.3.7 Additional COR Field Acceptance Testing

If any of the duct sections checked for a given system are determined to have a leakage rate measured that exceeds the leakage rate allowed by SMACNA Leak Test Manual for an indicated duct construction class and sealant class, terminate data checking for that section. The associated Pre-final DALT Report data for the given duct system will be disapproved. Make the necessary corrections and prepare a revised Pre-final DALT Report. Reschedule a field check of the revised report data with the COR.

3.3.8 Certified Final DALT Report

On successful completion of all field checks of the Pre-Final DALT Report data for all systems, the TAB Supervisor shall assemble, review, approve, sign and submit the Final DALT Report in compliance with Appendix B REPORTS - DALT and TAB to the Contracting Officer for approval.

3.3.9 Prerequisite for TAB Field Work

Do not commence TAB field work prior to the completion and approval, for all systems, of the Final DALT Report.

3.4 TAB PROCEDURES

3.4.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the the requirements of AABC MN-1, or SMACNA 1780 (TABB) and SMACNA 1858 (TABB),except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Conduct TAB work, including measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC MN-4, or NEBB TABES and NEBB MASV, or SMACNA 1780 (used by TABB) and SMACNA 1858 sound measurement procedures, except as supplemented and modified by this section.

3.4.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.4.3 TAB Air Distribution Systems

3.4.3.1 Units With Coils

Report heating and cooling performance capacity tests for hot water, chilled water, DX and steam coils for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

a. For air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of AABC MN-4, Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with AABC MN-4, Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

b. For units with capacities of 7.5 tons (90,000 Btu) or less, such as fan coil units, duct mounted reheat coils associated with VAV terminal units, and unitary units, such as through-the-wall heat pumps:

Determine the apparent coil capacity by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; submit the calculations with the coil reports.

3.4.3.2 Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, variable air volume boxes, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

3.4.3.3 Outside Air Units

Outside air unit systems including fans, coils, ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.4 Cassette and Horizontal Ducted Units

Cassettes and horizontal ducted unit systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

3.4.3.5 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.4.4 TAB Work on Performance Tests Without Seasonal Limitations

3.4.4.1 Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the heating systems and cooling systems.

3.4.4.2 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.4.5 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air and water flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Contracting Officer for direction.

3.4.6 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.4.7 TAB Reports

Additional requirements for TAB Reports are specified in Appendix B REPORTS - DALT and TAB

3.4.8 Quality Assurance - COR TAB Field Acceptance Testing

3.4.8.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COR, random selections of data (water, air quantities, and air motion) recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: Air handling units, cassettes and horizontal duct mounting units.

Group 2: 25 percent of the Change-over Bypass Dampers and associated diffusers and registers.

Group 3: 25 percent of the supply diffusers, registers, grilles associated with constant volume air handling units.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply and exhaust fans.

Further, if any data on the TAB Report for Groups 2 through 5 is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, additional group data verification is required in the presence of the COR. Verify TAB Report data for one additional piece of equipment in that group. Continue this additional group data verification until out-of-tolerance data ceases to be found.

3.4.8.2 Additional COR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the

necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COR.

3.4.8.3 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

3.5 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.6 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

3.7 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS
Appendix B REPORTS - DALT and TAB
Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE
Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

Appendix A

WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

1. Contractor

a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.

b. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.

c. Pre-DALT and TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.

d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.

e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph entitled "Construction Deficiencies." Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.

f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.

g. Give Notice of Testing: Submit advance notice of TAB field work accompanied by completed prerequisite HVAC Work List

h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.

b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.

c. Submittals: Provide the submittals specified herein.

d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.

e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the DALT or TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.

h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.

i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph entitled "Construction Deficiencies."

Resolve each deficiency as soon as practical and submit revised schedules and other required documentation.

j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.

3. TAB Team Field Leader

a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."

b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.

c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

Appendix B

REPORTS - DALT and TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. DALT and TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. Include the following:

a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.

b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.

c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.

d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.

e. A list of DALT and TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.

f. A thorough checklist of the work items and inspections that need to be accomplished before DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.

g. A thorough checklist of the work items and inspections that need to be accomplished before the TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-TAB Work Checklist before the TAB field work can be accomplished.

h. The checklists specified above shall be individually developed and tailored specifically for the work under this contract. Refer to NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under the paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" for examples of items to include in the checklists.

3. Design Review Report

Submit report containing the following information:

a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.

b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.

4. Pre-Final DALT Report for COR DALT Field Checks

Report the data for the Pre-Final DALT Report meeting the following requirements:

a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.

b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1143. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.

c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.

d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.
Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.

e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

5. Final DALT Report

On successful completion of all COR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

6. TAB Reports: Submit TAB Report in the following manner:

a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.

b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.

c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:

All occupied spaces.

(1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.

(2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.

(3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the TAB Report.

d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.

e. Air Static Pressure Profiles: Report static pressure profiles for air duct systems including: AHU-1, OAU-1, and AH-1 types. Report static pressure data for all supply, return, relief, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB or TABB required data, the following:

(1) Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.

(2) Report static pressure drop across chilled water coils, DX coils, hot water coils, steam coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.

(3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.

(4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

(5) Report static pressure drop across outside air and relief/exhaust air louvers.

(6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.

f. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

g. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.

h. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.

i. Data From TAB Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

-- End of Section --

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A240/A240M	(2011a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A580/A580M	(2008) Standard Specification for Stainless Steel Wire
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C1126	(2011e1) Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C1136	(2010) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1290	(2011) Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C1427	(2007e1) Specification for Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form

ASTM C195	(2007) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C449	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C533	(2011) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534/C534M	(2008) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C547	(2011) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C591	(2011) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C610	(2010) Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM C647	(2008) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C795	(2008) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

ASTM D882	(2010) Tensile Properties of Thin Plastic Sheeting
ASTM E2231	(2009) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
ASTM E84	(2011b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2010) Standard Test Methods for Water Vapor Transmission of Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2012) Standard for the Installation of Warm Air Heating and Air Conditioning Systems

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T403 OM	(2010) Bursting Strength of Paper

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-24179	(1969; Rev A; Am 2 1980; Notice 1 1987) Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-A-3316	(1987; Rev C; Am 2 1990) Adhesives, Fire-Resistant, Thermal Insulation

UNDERWRITERS LABORATORIES (UL)

UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials

UL 94 (1996; Reprint Oct 2010) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SYSTEM DESCRIPTION

1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

1.2.2 Surface Burning Characteristics

Unless otherwise specified, insulation shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Test specimens shall be prepared and mounted according to ASTM E2231. Insulation materials located exterior to the building perimeter are not required to be fire rated.

1.2.3 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meets all other requirements of this section. The minimum recycled material content of the following insulation are:

Rock Wool	75 percent slag of weight
Fiberglass	20-25 percent glass cullet by weight
Rigid Foam	9 percent recovered material

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-03 Product Data

Pipe Insulation Systems;
Duct Insulation Systems;

SD-04 Samples

Thermal Insulation;

SD-08 Manufacturer's Instructions

Pipe Insulation Systems;

Duct Insulation Systems;

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material. Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet. Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems which are located within, on, under, and adjacent to buildings; and for plumbing systems. Insulation shall be CFC and HCFC free.

2.2 MATERIALS

Provide insulation that meets or exceed the requirements of ASHRAE 90.1 - IP. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C795 requirements. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free and conform to the following:Flexible Elastomeric: Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive. Comply with ASTM C534/C534M, Type I, Grade 1, for tubular materials and Type II, Grade 1, for sheet

materials. Provide product recognized under UL 94 and listed in FM APP GUIDE.

2.2.1 Adhesives

2.2.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C916, Type I.

2.2.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C195.

2.2.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Adhesive shall be MIL-A-3316, Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation. Submit and display, after approval of materials, actual sections of installed systems, properly insulated in accordance with the specification requirements. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

a. Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

b. Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A temporary covering shall be used to enclose and protect display sections for duct insulation exposed to weather.

2.2.2 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product recognized under UL 94 and listed in FM APP GUIDE.

2.2.3 Caulking

ASTM C920, Type S, Grade NS, Class 25, Use A.

2.2.4 Corner Angles

2.2.4.1 General

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209, Alloy 3003, 3105, or 5005.

2.2.4.2 Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor).

2.2.5 Finishing Cement

ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C795.

2.2.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

2.2.7 Staples

Outward clinching type monel.

2.2.8 Jackets

2.2.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.2.8.2 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

2.2.9 Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber, cellular glass, polyisocyanurate, and phenolic foam. Insulation materials that do not require jacketing are flexible elastomerics. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.9.1 White Vapor Retarder All Service Jacket (ASJ)

Standard reinforced fire retardant jacket for use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.2.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings

a. The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Less than 0.02 permeability when tested in accordance with ASTM E96/E96M. Meeting UL 723 or ASTM E84 flame and smoke requirements; UV resistant.

b. The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined according to procedure B of ASTM E96/E96M utilizing apparatus described in ASTM E96/E96M. The coating shall be a nonflammable, fire resistant type. All other application and service properties shall be in accordance with ASTM C647.

2.2.9.3 Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and excellent WVT.

2.2.9.4 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 30 lb/inch when tested in accordance with ASTM D882, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.9.5 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for Laminated Film Vapor Retarder above.

2.2.9.6 Vapor Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with ASTM E96/E96M). Vapor barrier shall meet UL 723 or ASTM E84 25 flame and 50 smoke requirements; and UV resistant. Minimum burst strength 185 psi in accordance with TAPPI T403 OM. Tensile strength 68 lb/inch width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

2.2.10 Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.11 Wire

Soft annealed ASTM A580/A580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2.12 Insulation Bands

Insulation bands shall be 1/2 inch wide; 26 gauge stainless steel.

2.2.13 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.3 PIPE INSULATION SYSTEMS

Insulation materials shall conform to Table 1. Insulation thickness shall be as listed in Table 2 and meet or exceed the requirements of ASHRAE 90.1 - IP. Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 Aboveground Cold Pipeline (-30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

a. Cellular Glass: ASTM C552, Type II, and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

b. Flexible Elastomeric Cellular Insulation: ASTM C534/C534M, Grade 1, Type I or II. Type II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation.

c. Phenolic Insulation: ASTM C1126, Type III. Phenolic insulations shall comply with ASTM C795 and with the ASTM C665 paragraph Corrosiveness. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

d. Polyisocyanurate Insulation: ASTM C591, type I. Supply the insulation with manufacturer's recommended factory-applied vapor retarder/vapor barrier. Insulation with pre-applied adhesive shall not be used.

e. Flexible Polyolefin Cellular Insulation: ASTM C1427, Grade 1 Type I or II.

f. Mineral Fiber Insulation with Integral Wicking Material (MFIWM): ASTM C547. Install in accordance with manufacturer's instructions.

2.3.2 Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

a. Mineral Fiber: ASTM C547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

b. Calcium Silicate: ASTM C533, Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket/vapor barrier.

c. Cellular Glass: ASTM C552, Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

d. Flexible Elastomeric Cellular Insulation: ASTM C534/C534M, Grade 1, Type I or II to 220 degrees F service.

e. Phenolic Insulation: ASTM C1126 Type III to 250 degrees F service shall comply with ASTM C795. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

f. Perlite Insulation: ASTM C610

g. Polyisocyanurate Insulation: ASTM C591, Type 1, to 300 degrees F service. Supply the insulation with manufacturer's recommended factory applied jacket/vapor barrier.

h. Flexible Polyolefin Cellular Insulation: ASTM C1427, Grade 1 Type I or II to 200 degrees F.

2.4 DUCT INSULATION SYSTEMS

2.4.1 Duct Insulation

Provide factory-applied cellular glass polyisocyanurate or phenolic foam insulation with insulation manufacturer's standard reinforced fire-retardant vapor barrier, with identification of installed thermal resistance (R) value and out-of-package R value.

2.4.1.1 Rigid Insulation

Rigid mineral fiber in accordance with ASTM C612, Class 2 (maximum surface temperature 400 degrees F), 3 pcf average, 1-1/2 inch thick, Type IA, IB, II, III, and IV.

2.4.1.2 Blanket Insulation

Blanket flexible mineral fiber insulation conforming to ASTM C553, Type 1, Class B-3, 3/4 pcf nominal, 2.0 inches thick or Type II up to 250 degrees F. Also ASTM C1290 Type III may be used.

2.4.2 Duct Insulation Jackets

2.4.2.1 All-Purpose Jacket

Provide insulation with insulation manufacturer's standard reinforced fire-retardant jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jacket with a white surface suitable for field painting.

2.4.2.2 Metal Jackets

a. Aluminum Jackets: ASTM B209, Temper H14, minimum thickness of 27 gauge (0.016 inch), with factory-applied polyethylene and kraft paper

moisture barrier on inside surface. Provide smooth surface jackets for jacket outside dimension 8 inches and larger. Provide corrugated surface jackets for jacket outside dimension 8 inches and larger. Provide stainless steel bands, minimum width of 1/2 inch.

b. Stainless Steel Jackets: ASTM A167 or ASTM A240/A240M; Type 304, minimum thickness of 33 gauge (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 1/2 inch.

2.4.2.3 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive), heavy duty white or natural).

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi-layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.2 Firestopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in DIVISION 07 - THERMAL AND MOISTURE PROTECTION. The protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by UL, FM, or a NRTL.

3.1.3 Painting and Finishing

Painting shall be as specified in DIVISION 09 - FINISHES.

3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 220 degrees F. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish or PVC or metal jacketing as recommended by the manufacturer after the adhesive is dry and cured. A brush coating of adhesive shall be applied to both butt ends to be joined and to both slit surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.5 Welding

No welding shall be done on piping, duct</TAI> or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Air chambers.

e. Adjacent insulation.

f. ASME stamps.

g. Access plates of fan housings.

h. Cleanouts or handholes.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where pipes penetrate interior walls, the aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 plies standard grade, silver, white, black and embossed shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

h. For hot water pipes supplying lavatories or other similar heated service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.

i. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inches.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers in accordance with MSS SP-69, and Section 22 00 00 PLUMBING, GENERAL PURPOSE.

c. Horizontal pipes larger than 2 inches and below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, prefabricated insulation pipe hangers, perlite above 80 degrees F), or the necessary strength polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as

an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.1.5 Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, welded PVC, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket, - less than 0.0000 permeability; (greater than 3 ply, standard grade, silver, white, black and embossed) aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

3.2.1.6 Pipe Insulation Material and Thickness

TABLE 1
Insulation Material for Piping
Service

	Material	Specification	Type	Class	VR/VB Req'd
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping					
	Polyisocyanurate	ASTM C591	I		Yes
	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Flexible Polyolefin Cellular	ASTM C1427	I		No
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)					
	Mineral Fiber	ASTM C547	I	1	No
	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Polyisocyanurate	ASTM C591	I		No
Refrigerant Suction Piping (1.67 degrees C35 degrees Fnominal)					

	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Cellular Glass	ASTM C552	II	1	Yes
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Polyisocyanurate	ASTM C591	I		Yes
Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas for Handicapped Personnel					
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Flexible Polyolefin Cellular	ASTM C1427	I		No
Hoizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)					
	Polyisocyanurate	ASTM C591	I		Yes
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	III		Yes
	Cellular Glass	ASTM C552	III		Yes
Condensate Drain Located Inside Building					
	Polyisocyanurate	ASTM C591	I		Yes

	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Faced Phenolic Foam	ASTM C1126	II		Yes
Note: VR/VB = Vapor Retarder/Vapor Barrier					

TABLE 2

Piping Insulation Thickness (mminch)
For flexible cellular foam the thickness should be 13mm instead of 15mm. Economic thicknessor prevention of condensation is the basis of these tables. If prevention of condensation is the criterion, the ambient temperature and relative humidity must bestated.

Service

	Material	Tube And Pipe Size (mm) (inch)				
		<25<1	25-<401-<1.5	40-<1001.5-<4	100-<2004-<8	> or = 200>8
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A

	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)						
	Mineral Fiber	251	251	251	401.5	401.5
	Cellular Glass	401.5	401.5	401.5	502	502
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Polyisocyanurate	251	251	251	251	401.5
Refrigerant Suction Piping (1.67 degrees C35 degrees Fnominal)						
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251

Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas forHandicapped Personnel						
	Flexible Elastomeric Cellular	130.5	130.5	130.5	130.5	130.5
Hoizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Faced Phenolic Foam	251	251	251	251	251
	Polyisocyanurate	251	251	251	251	251
Condensate Drain Located Inside Building						
	Cellular Glass	401.5	401.5	401.5	401.5	401.5
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
	Faced Phenolic Foam	251	251	251	251	251

3.2.2 Aboveground Cold Pipelines

The following cold pipelines for minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

a. Make-up water.

b. Horizontal and vertical portions of interior roof drains.

c. Refrigerant suction lines.

d. Air conditioner condensate drains.

e. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

f. Domestic cold and chilled drinking water.

3.2.2.1 Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

3.2.2.2 Factory or Field applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or field applied seal welded PVC jacket or greater than 3 ply laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, standard grade, sliver, white, black and embossed for use with Mineral Fiber, Cellular Glass, Phenolic Foam, and Polyisocyanurate Foam Insulated Pipe. Insulation inside the building, to be protected with an aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, Embossed Silver, White & Black, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, White & Black, shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white & black, shall be provided for pipe insulation to the 6 ft level.

3.2.2.3 Installing Insulation for Straight Runs Hot and Cold Pipe

a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating, greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or PVDC adhesive tape.

b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. If staples are used, they shall be sealed in accordance with item "e." below. Note that staples are not required with cellular glass systems.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. The patch shall extend not less than 1-1/2 inches past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

h. Installation of flexible elastomeric cellular pipe insulation shall be by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut.Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives shall be used. Grade 1, Type II sheet insulation when used on pipe larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow'. Submit a booklet containing completed MICA Insulation Stds plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.

(1) The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.

(2) If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with either greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape, standard grade, silver, white, black and embossed or PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

3.2.3.1 General Requirements

All hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

a. Domestic hot water supply & re-circulating system.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.3.2 Insulation for Fittings and Accessories

a. General. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

b. Precut or Preformed. Precut or preformed insulation shall be placed around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

c. Rigid Preformed. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular

insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe.

PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant.

3.2.4.3 PVC Jacket

PVC jacket shall be ultraviolet resistant and adhesive welded weather tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.3 DUCT INSULATION SYSTEMS INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

3.3.1 Duct Insulation Thickness

Table 3		
Minimum Duct Insulation		
	Cooling	Heating

Duct Location	Annual Cooling Degree Days Base 18 C 65 F	Insulation R-Value (sm K)/W (h sf F)/Btu	Annual Heating Degree Days Base 18 C 65 F	Insulation R-Value (sm K)/W (h sf F)/Btu
Exterior of Building	<260500	0.583.3	<8161500	0.583.3
	260 - 621500 - 1150	0.885.0	816 - 24821500 - 4500	0.885.0
	622 - 10931151 - 2000	1.146.5	2483 - 41494501 - 7500	1.146.5
	>10932000	1.418.0	>41497500	1.418.0
	Temperature Difference	Insulation R-Value (sm K)/W (h sf F)/Btu	Temperature Difference	Insulation R-Value (sm K)/W (h sf F)/Btu
Inside building envelope or in unconditioned spaces	<815	None required	<815	None required
	8 <TD <2215 <TD <40	0.583.3	8 <TD <2215 <TD <40	0.583.3
	22 <TD40 <TD	0.885.0	22 <TD40 <TD	0.885.0

These R-values do not include the film resistances. The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit vapor transmission and condensation. Where ducts are designed to convey both heated and cooled air, duct insulation shall be as required by the most restrictive condition. Where exterior walls are used as plenum walls, wall insulation shall be a required by the most restrictive condition of this section or the insulation for the building envelope. Cooling ducts are those designed to convey mechanically cooled air or return ducts in such systems. Heating ducts are those designed to convey mechanically heated air or return ducts in such systems. Thermal resistance will be measured in accordance with ASTM C518 at a mean temperature of 24 degrees C 75 drgrees F. The Temperature difference is at design conditions between the space withinwhich the duct is located and the design air temperature in the duct. Resistance for runouts to terminal devices less than 3 m10 feet in length need not exceed 0.58 (sm K)/W3.3 (h sf F)/Btu. Unconditioned spaces include crawlspaces and attics.

Duct insulation thickness shall be in accordance with Table 4.

Table 4 - Minimum Duct Insulation (mm) (inches)	
Cold Air Ducts	502.0

Relief Ducts	401.5
Fresh Air Intake Ducts	401.5
Warm Air Ducts	502.0
Relief Ducts	401.5
Fresh Air Intake Ducts	401.5

3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible run-outs (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

i. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf, and rigid type where exposed, minimum density 3 pcf. Insulation for both concealed or exposed round/oval ducts shall be flexible type, minimum density 3/4 pcf or a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered. Insulation for all exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a field applied vapor retarder/vapor barrier jacket coating finish as specified, the total field applied dry film thickness shall be approximately 1/16 inch. Insulation on all concealed duct shall be provided with a factory-applied Type I or II vapor retarder/vapor barrier jacket. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder/vapor barrier shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder/vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, flexible insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder/vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Where mechanical fasteners are used, self-locking washers shall be installed and the pin trimmed and bent over.

f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

a. Supply ducts.

b. Return air ducts.

c. Relief air ducts

d. Flexible run-outs (field insulated).

e. Plenums.

f. Duct-mounted coil casings.

i. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, and rigid type where exposed. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured and stapled on 4 inch centers.

3.3.3.2 Installation on Exposed Duct

a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 16 inches apart and not more than 6 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.

b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin trimmed and bent over.

d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of tape and brushed with vapor retarder coating.

e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by staples spaced not more than 16 inches and not more than 6 inches from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

-- End of Section --

SECTION 23 08 00.00 23N

COMMISSIONING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA DCS	(1995, 2nd Ed) HVAC Duct Construction Standards - Metal and Flexible

1.2 DEFINITIONS

1.2.1 Commissioning

The process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent.

1.2.2 Commissioning Authority (Designation Ca)

The person, persons, or Company responsible, on the Government's behalf, for ensuring the commissioning process is fully carried out according to the contract requirements.

1.2.3 Commissioning Agent (Designation Cx)

The person responsible, on the contractors behalf, for carrying out the detailed planning, and implementation of, the commissioning process.

1.2.4 Design Agent (Designation D)

The Designer of Record. For IDIQ task orders, this is typically the Government PM.

1.2.5 TAB

Testing, Adjusting and Balancing

1.2.6 BAS

Building Automation System

1.2.7 DDC

Direct Digital Control

1.2.8 Season 1

That season when the HVAC System is up against maximum loading for the first time after completion of construction. Season 1 can be summer or winter depending on when construction is completed.

1.2.9 Season 2

That season when the HVAC System is up against maximum loading for the second time after completion of construction. Season 2 is the opposite of season 1. I.e. if Season 1 was summer, Season 2 will be winter.

1.2.10 Shoulder Season

That time of the season when the HVAC System is up against part load conditions.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Commissioning Team;

List of team members with company name and contact information who will represent the Contractor in the pre-commissioning checks and functional performance testing.

Test Reports;

All test reports, manufacturer's start-up tests, and executed and signed pre-commissioning checklists and functional performance test checklists required by the executive plan. The results of failed tests shall be included along with a description of the corrective action taken.

SD-07 Certificates

Certificates;

Provide Contractor's Commissioning Agent qualifications and resume. The Contractor's Commissioning Agent shall be Certified by a recognized Building HVAC Commissioning Program per the National Environmental Balancing Bureau or the Associated Air Balance Council or the Building Commissioning Association.

Additionally, for the Commissioning Agent proposed for approval, submit information certifying that the Commissioning Agent is part of the General Contractor's (GC's) staff or first tier certified TAB company or is a first tier subcontractor who is not affiliated with any other company participating in work on this contract.

SD-10 Operation and Maintenance Data

Operation and Maintenance;

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.4 SEQUENCING AND SCHEDULING

The work described in Checklist A of this Section shall be completed in conjunction with the startup of the HVAC systems and the related sections listed herein. The work described in Checklist B of this section shall begin only after all work required in this and related Sections has been successfully completed, and all tests and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Related Sections include, but are not limited to:

Section 01 45 00 CONSTRUCTION QUALITY CONTROL
Section 23 09 54.00 20 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC SYSTEMS
Section 23 08 00.00 20 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
Division 23XXX Mechanical systems as applicable

1.5 RELATED REQUIREMENTS

Requirements for construction scheduling, including commissioning activities, are specified in Section 01 32 00 PROJECT SCHEDULE.

Construction Quality Control Program commissioning requirements are specified in Section 01 45 00.

1.6 COMMISSIONING MEETINGS

Conduct weekly commissioning meetings during the period when commissioning activities take place.

1.7 PRICE AND PAYMENT PROCEDURES FOR COMMISSIONING RELATED ACTIVITIES

Payment for HVAC Systems shall not exceed 70% for the system labor and material cost until such time as the system commissioning as defined by this section is complete and accepted by the government.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

The Contractor shall designate team members to participate in the pre-commissioning checks and the functional performance testing specified herein. The Commissioning Agent is responsible for ensuring the completeness and technical accuracy of the commissioning plan. In addition, the Government will be represented by a representative of the Contracting Officer and the Design Agent's Representative. The team members shall be as follows:

Designation	Function
Cx	Contractor's Commissioning Agent
Q	Contractor's Quality Control Representative
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing Representative
C	Contractor's Controls Representative
D	Design Agent's Representative (Gov't)
Ca	Contracting Officer's Representative

Appendices A and B are provided as a general checklist and have been prepared to best match the various equipment selected during the design of this project. Each checklist shown in Appendices A and B shall be reviewed and modified as necessary to reflect all equipment actually installed during construction of the project. The commissioning team shall review the accuracy and applicability of each item in the checklist and revise as needed. Equipment shown in the checklist but not installed for the project shall be annotated as "NA". Likewise, equipment installed but not listed in the checklist shall be added or revised accordingly. A note as to why it was added or revised shall be inserted with the reviewer's initial. The commissioning team shall also add or modify to any of the equipment checklist items as required and/or specified by the equipment manufacturer. Acceptance by each commissioning team member of each pre-commissioning checklist item shall be indicated by initials and date, unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test checklist shall be indicated by signature and date.

3.2 TESTS

The pre-commissioning checks and functional performance tests shall be performed on all HVAC equipment in a manner which essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required, including part load testing. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and labor required to perform the pre-commissioning checks and functional performance tests. A pre-commissioning check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members. The Contractor shall submit Test Reports as specified in the Submittals paragraph.

3.2.1 Pre-Commissioning Checks

Pre-commissioning checks shall be performed for the items indicated on the checklists in Appendix A. All related manufacturer's start up sheets shall

be attached to the appropriate checklist. Deficiencies discovered during these checks shall be documented, corrected and retested in accordance with the applicable contract requirements.

3.2.2 Functional Performance Tests

Functional performance tests shall be performed for the items indicated on the checklists in Appendix B. Functional performance tests shall begin only after all pre-commissioning checks and work required in specification sections listed in the SEQUENCING AND SCHEDULING section have been successfully completed. Tests shall prove Heating, Cooling and Part Load sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall document and correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

3.3 INDEX OF CHECK LISTS

A Pre-commissioning Check Lists

A-1 Structural/Architectural Checklist
A-2 Piping
A-3 Ductwork
A-6 Variable Volume Air Handling Unit
A-7 VAV Terminal
A-8 DX Air Cooled Condensing Unit
A-9 Pumps
A-10 Packaged Air Cooled Chiller
A-15 Blower Coil Unit
A-16 Fan Coil Unit
A-17 Unit Heater
A-18 Exhaust Fan
A-19 Make Up Air Fan
A-20 HVAC System Controls

B. Functional Performance Tests (FPT) and Check Lists

B-1 Pumps
B-4 VAV Terminals
B-5 Variable Volume Air Handling Unit
B-8 Packaged Air Cooled Chiller

B-11 Blower Coil Unit
B-12 Fan Coil Units
B-13 Unit Heaters

B-15 Make Up Air Fan
B-16 Exhaust Fan

3.4 APPENDIX A

PRE-COMMISSIONING CHECKLISTS

A-1 Pre-commissioning Checklist - Structural/Architectural Checklist

For Building or Zone:

Checklist Item	Q	M	E	T	C	D	Ca	Cx
a. Verify all piping,ductwork,EMT,etc. wall/ceiling and floor penetrations in Mesh. rooms or utility chases are sealed with approved fire stopping and/or weatherproof sealants.	___	X	X	X	X	___	_	___
b. Verify the fire rating for the Mesh. equipment room(s) is met per the plans and specs.	___	X	X	X	X	___	_	___
c. Verify the Bldg. envelope is sealed	___	X	X	X	X	___	_	___

per the plans and specs.

d.	Verify the fenestration is rated per the plans and specs and installed correctly. (Fire ratings, force protection, window system shading coefficient / emissivity).	___	XX	X	X	_____
e.	Verify the building is sealed and walls,doors,and dropped ceilings in place prior to the TAB air balance work.	___	X	X	___ X	_____

A-2 Pre-commissioning checklist - Piping

For Chilled Water Piping System

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).			X	X	X			
b. Piping complete.			X					
c. As-built shop drawings submitted.			X					
d. Piping flushed and cleaned and initial chemical treatment added.			X					
e. Strainers cleaned.			X					
f. Valves installed as required.			X		X			
g. Piping insulated as required.			X					
h. Thermometers and gauges installed as required.			X		X			
i. Verify operation of valves.			X					
j. Air vents installed as specified.			X	X	X			
k. Flexible connectors installed as specified			X	X	X			
l. Verify that piping has been labeled and valves identified as specified.			X					
m. Hydrostatic test complete.			X		X			
n. Verify insulation support blocks installed at piping loading points.			X		X			

A-3 Pre-commissioning Checklist - Ductwork

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Ductwork complete.			X		X			
c. As-built shop drawings submitted.			X		X			
d. Ductwork leak test complete.			X		X			
e. Fire dampers, smoke dampers, and access doors installed as required.			X		X			
e. Fire dampers, smoke dampers, and access doors installed as required with installation of each verified by the specified team members initialing each location on a copy of the as-built drawings.			X		X			
f. Ductwork insulated as required.			X		X			
g. Thermometers and gauges installed as required.								
h. Verify open/closed status of dampers.			X		X			
i. Verify smoke and fire damper operation.			X					
j. Flexible connectors installed as specified			X		X			
k. Verify duct systems installed per SMACNA DCS			X		X			

A-6 Pre-commissioning Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1, AHU-2

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			

b. Vibration isolation devices installed. _____ X X X _____

c. Inspection and access doors are operable and sealed.		X		X	
d. Casing undamaged.		X	X	X	
e. Insulation undamaged.		X	X	X	
f. Condensate drainage is unobstructed and sloped correctly. (Visually verify drainage by pouring a cup of water into drain pan.)		X	X	X	
g. Fan belt adjusted.		X		X	
h. Manufacturer's required maintenance clearance provided.		X	X	X	
Electrical					
a. Power available to unit disconnect.			X	X	
b. Power available to unit control panel.			X		
c. Proper motor rotation verified.				X	
d. Verify that power disconnect is located within sight of the unit it controls.			X		
f. Verify proper overload protection for motor starters.			X		
g. Verify that frequency drive, cables, and motor are compatible.			X		
h. Verify that the frequency drive programming is application specific.			X		
Coils					
a. Chilled water piping properly connected.		X	X	X	
b. Chilled water piping pressure tested.		X	X	X	
c. Air vents installed on water coils with shutoff valves as specified.		X	X	X	
d. Any damage to coil fins has been repaired.		X		X	
Controls					

a. Control valves/actuators properly installed.	_____	X	_____	___	___	
b. Control valves/actuators operable.	___	___	X	_____		

c. Dampers/actuators properly installed.		X				
d. Dampers/actuators operable.		X				
e. Verify proper location, installation and calibration of duct static pressure sensor.		X				
f. Fan air volume controller operable.		X				
g. Air handler controls system operational.		X				
Testing, Adjusting, and Balancing (TAB)						
a. Construction filters removed and replaced.			X		X	
b. Permanent Strainers cleaned or Construction strainers removed and replaced.		X		X		

A-7 Pre-commissioning Checklist - VAV Terminal

For all VAV Terminal

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. VAV terminal in place.			X	X	X			
c. VAV terminal ducted.			X	X	X			
d. VAV terminal connected to controls.			X	X				
e. Electric reheat coil connected to local disconnect and heater sized properly with proper overload protection.					X			
f. Manufacturer's required maintenance clearance provided.			X	X	X			
Controls								
a. Cooling only VAV terminal controls set.			X	X				
b. Cooling only VAV controls verified.			X	X				
c. Reheat VAV terminal controls set.			X	X				
d. Reheat terminal/coil controls verified.			X	X				
Testing, Adjusting, and Balancing (TAB)								
a. Verify terminal maximum air flow set.			X					
b. Verify terminal minimum air flow set.			X					
c. Verify that flow coefficient is programmed properly.			X					
d. Permanent Strainers cleaned or Construction strainers removed and replaced.			X		X			

A-9 Pre-commissioning Checklist - Pumps

For Pump: P-1, P-2

Checklist Item	Q	M	E	T	C	D	Ca	Cx

Installation					
a. Verify that item(s) installed meet approved submittal(s).			X	X	
b. Pump vibration isolation devices functional.		X	X	X	
c. Pump/motor coupling alignment verified.		X	X	X	
d. Piping system installed.		X	X	X	
e. Piping system pressure tested.		X	X	X	
f. Pump not leaking.		X	X	X	
g. Field assembled couplings aligned to meet manufacturer's prescribed tolerances.		X	X	X	
h. Pressure/temperature gauges installed.		X		X	
i. Piping system cleaned.		X	X	X	
j. Chemical water treatment complete.		X	X	X	
Electrical					
a. Power available to pump disconnect.			X	X	
b. Pump rotation verified.			X	X	
c. Control system interlocks functional.			X		
d. Verify that power disconnect is located within sight of the unit it controls.			X		
e. Verify proper overload protection for motor starters.			X		
f. Verify that frequency drive, cables, and motor are compatible.			X		
g. Verify that the frequency drive programming is application specific.			X		

Testing, Adjusting, and Balancing (TAB)

a. Permanent Strainers cleaned or Construction strainers removed and replaced.	_____	X	___	X _____

A-10 Pre-commissioning Checklist - Packaged Air Cooled Chiller

For Chiller: ACC-1

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Chiller properly piped.			X					
c. Chilled water pipe leak tested.			X	X	X			
d. Verify that refrigerant used complies with specified requirements.			X	X	X			
e. Any damage to coil fins has been repaired.			X		X			
f. Manufacturer's required maintenance clearance provided.			X	X	X			
g. Verify proper chiller barrel and piping heat trace installed per manufacturer's recommendations.			X	X	X			
h. Verify unit has Hot Gas Bypass.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Power available to unit control panel.				X				
c. Separate power is supplied to electric heating tape with GFCI breakers.				X				
d. Verify that power disconnect is located within sight of the unit it controls.				X				
Controls								
a. Factory startup and checkout complete.			X	X				
b. Chiller safety/protection devices tested.			X	X				
c. Chilled water flow switch installed.			X	X				
d. Chilled water flow switch tested.			X	X				
e. Chilled water pump interlock installed.			X	X	X			

f. Chilled water pump interlock tested. _____ X _____ ___

[g. Verify low ambient controls. _____ X _____ ___] ___

A-15 Pre-commissioning Checklist - Blower Coil Unit

Blower Coil Unit

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).	___	_____		X	X		_____	
b. Vibration isolation devices installed.	_____		X	X	X		_____	
c. Access doors/removable panels are operable and sealed.	_____		X	___	X		_____	
d. Casing undamaged.	_____		X	X	X		_____	
e. Insulation undamaged.	_____		X	X	X		_____	
f. Condensate drainage is unobstructed and sloped correctly.	_____		X	X	X		_____	
g. Fan belt adjusted.	_____		X	___	X		_____	
h. Any damage to coil fins has been repaired.	_____		X	___	X		_____	
i. Manufacturer's required maintenance clearance provided.	_____		X	X	X		_____	
j. Verify installation of auxiliary drain pan for control valves.	_____		X	X	X		_____	
k. Verify air vent installed per manufacturer's recommendations.	_____		X	X	X		_____	
Electrical								
a. Power available to unit disconnect.	_____			X	_____			___
b. Power available to unit control panel.	_____			X	_____			___
c. Proper motor rotation verified.	___	___	_____		X		_____	
d. Verify that power disconnect is located within sight of the unit it controls.	_____			X	_____			___
e. Power available to electric heating coil.	_____	___	X		X		_____	
f. Verify proper overload protection for _____ motor starters.								

___ X _____

Controls

a. Control interlocks properly installed.			X		
b. Control interlocks operable.			X		
c. Dampers/actuators properly installed.		X			
d. Dampers/actuators operable.		X			
e. Verify proper location and installation of thermostat.		X			

A-16 Pre-commissioning Checklist - Fan Coil Unit

Fan Coil Unit

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Vibration isolation devices installed.			X	X	X			
c. Access doors/removable panels are operable and sealed.			X		X			
d. Casing undamaged.			X	X	X			
e. Insulation undamaged.			X	X	X			
f. Condensate drainage is unobstructed and sloped correctly.			X	X	X			
g. Fan belt adjusted.			X		X			
h. Any damage to coil fins has been repaired.			X		X			
i. Manufacturer's required maintenance clearance provided.			X	X	X			
j. Verify installation of auxiliary drain pan for control valves.			X	X	X			
k. Verify air vent installed per manufacturer's recommendations.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Power available to unit control panel.				X				
c. Proper motor rotation verified.					X			
d. Verify that power disconnect is located within sight of the unit it controls.				X				
e. Power available to electric heating coil.			X	X				

f. Verify proper overload protection for motor starters. _____ ___ X _____

Coils

a. Chilled water piping properly connected.		X	X	X		
b. Chilled water piping pressure tested.		X	X	X		
c. Verify coil filled and vented of air.			X			

Controls

a. Control valves/actuators properly installed.		X				
b. Control valves/actuators operable.		X	X			
c. Verify proper location and installation of thermostat.		X				

Testing, Adjusting, and Balancing (TAB)

a. Construction filters removed and replaced.			X			
b. Permanent Strainers cleaned or Construction strainers removed and replaced.		X		X		

A-17 Pre-commissioning Checklist - Unit Heater

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Any damage to coil fins has been repaired.			X		X			
c. Manufacturer's required maintenance/ operational clearance provided.			X	X	X			
Electrical								
a. Power available to unit disconnect.				X				
b. Proper motor rotation verified.				X	X			
c. Verify that power disconnect is located within sight of the unit it controls.				X				
d. Power available to electric heating coil.				X				
e. Verify proper overload protection for motor starters.				X				
Controls								
a. Control valves properly installed.			X					
b. Control valves operable.			X	X				
c. Verify proper location and installation of thermostat.			X					
Testing, Adjusting, and Balancing (TAB)								
a. Permanent Strainers cleaned or Construction strainers removed and replaced.			X		X			

A-18 Pre-commissioning Checklist - Exhaust Fan

For Exhaust Fan

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Fan belt adjusted.			X		X			
c. Verify all ductwork is installed per design.			X		X			
Electrical								
a. Power available to fan disconnect.				X				
b. Proper motor rotation verified.					X			
c. Verify that power disconnect is located within sight of the unit it controls.				X				
d. Verify proper overload protection for motor starters.				X				
Controls								
a. Control interlocks properly installed.				X				
b. Control interlocks operable.				X				
c. Dampers/actuators properly installed.			X					
d. Dampers/actuators operable.			X					
e. Verify proper location and installation of thermostat.			X					

A-19 Pre-commissioning Checklist - Make-Up Air Fan

Installation

a. Verify that item(s) installed meet approved submittal(s).			X	X	
b. Fan belt adjusted.		X		X	
c. Verify all ductwork is installed per design.		X		X	

Electrical

a. Power available to fan disconnect.		X			
b. Proper motor rotation verified.				X	
c. Verify that power disconnect is located within sight of the unit it controls.		X			
d. Verify proper overload protection for motor starters.			X		

Controls

a. Control interlocks properly installed.			X		
b. Control interlocks operable.			X		
c. Dampers/actuators properly installed.		X			
d. Dampers/actuators operable.		X			
e. Verify proper location and installation of thermostat.		X			

A-20 Pre-commissioning Checklist - HVAC System Controls

Checklist Item	Q	M	E	T	C	D	Ca	Cx
Installation								
a. Verify that item(s) installed meet approved submittal(s).				X	X			
b. Layout of control panel matches drawings.			X	X				
c. Control components piped and/or wired to each labeled terminal strip.			X	X				
d. Verify that control components are installed in the proper location.			X	X				
e. Verify that force protection shut down controls installed in proper location.			X	X				
f. DDC connection made to each labeled terminal strip as shown.			X	X				
g. Control wiring and tubing labeled at all terminations, splices, and junctions.			X	X				
h. Shielded wiring used on electronic sensors.			X	X				
i. Verify location and coordination of modem/communication line.			X	X				
j. Verify damper actuators mounted outside the airstream and attached to proper structural support.			X	X				
k. Verify thermostats are located on interior walls with specified options and set to design setpoints.			X	X				
l. Verify that workstation is in proper location and includes all specified interfaces.			X	X				

Main Power and Control Air

a. 110 volt AC power available to panel.			X		
b. 20 psig compressed air available to panel.		X	X		
c. Verify proper overload protection for motor starters.			X		
d. Verify proper sizing and installation of individual control transformers.			X		
e. Verify proper surge protection of incoming power, control wiring, and communication lines.			X		

3.5 APPENDIX B

FUNCTIONAL PERFORMANCE TESTS (FPT) AND CHECKLISTS

All equipment and control systems shall be operated through the entire specified sequence of operations, as directed by the government for witnessing and verifying acceptable operation. Government shall select of specific components or systems to be verified. A functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test. Upon failure of any functional performance test, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. In the event of a failed FPT, Government shall have the right to require additional testing of at least similar systems. The Contractor shall reimburse the Government for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable) for Government commissioning team members.

B-1 Functional Performance Test Checklist - Pumps

For Pump: P-1, P-2

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Verify automatic interface with local controller and BAS/ operator work station.

2. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

3. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-4 Functional Performance Test Checklist - VAV Terminals

VAV boxes (Cooling only, Reheat)

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	
Contractor's Mechanical Representative	
Contractor's Electrical Representative	
Contractor's Testing, Adjusting and Balancing Representative	
Contractor's Controls Representative	
Contracting Officer's Representative	

B-5 Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1, AHU-2

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

5. Verify that the Variable Frequency Drive is not capable of running at any critical vibration frequencies.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-8 Functional Performance Test Checklist - Packaged Air Cooled Chiller

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

5. Verify that the Variable Frequency Drive is not capable of running at any critical vibration frequencies.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-11 Functional Performance Test Checklist - Steam Boiler

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____

B-12 Functional Performance Test Checklist - Fan Coil Units

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Agent	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____

B-13 Functional Performance Test Checklist - Unit Heaters

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

B. Shoulder Season

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

C. Season 2

1. Refer to control drawings for sequence of operation.

2. Verify automatic interface with local controller and BAS/ operator work station.

3. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

4. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-15 Functional Performance Test Checklist - Make Air Fan

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

B-16 Functional Performance Test Checklist - Exhaust Fan

A. Season 1

1. Refer to control drawings for sequence of operation.

2. Verify operation of Hand, Off, Automatic Control.

Hand_____, Off_____, Automatic _____

3. Verify automatic interface with local controller and BAS/ operator work station.

4. Generate graphed and text version of trend reports that demonstrate this specific sequence of operation. Data capture shall occur every 15 minutes and trend duration shall not exceed two weeks.

5. Verify that database is archived upon acceptance of FPT.

D. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Agent _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Contracting Officer's Representative _____

-- End of Section --

SECTION 23 09 23.13 20

BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(2007) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2010; INT 1 2011; Addenda AD & AE 2011) BACnet—A Data Communication Protocol for Building Automation and Control Networks

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1	(1999) Local Area Network: Token Bus

ASME INTERNATIONAL (ASME)

ASME B31.1	(2010) Power Piping
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-C	(2010) Control Network Protocol Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2008) Standard Requirements for Instrument Transformers
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.45	(2002; R 2008) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less)AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3	(2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code
NFPA 72	(2010; TIA 10-4) National Fire Alarm and Signaling Code
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449	(2006; Reprint Feb 2011) Surge Protective Devices
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 508A	(2001; Reprint Feb 2010) Industrial Control Panels
UL 916	(2007; Reprint Jun 2010) Standard for Energy Management Equipment

1.2 DEFINITIONS

1.2.1 ANSI/ASHRAE Standard 135

ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks, referred to as "BACnet". ASHRAE developed BACnet to provide a method for diverse building automation devices to communicate and share data over a network.

1.2.2 ARCNET

ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.

1.2.3 BACnet

Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

1.2.4 BACnet/IP

An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number. See also "BACnet Broadcast Management Device".

1.2.5 BACnet Internetwork

Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

1.2.6 BACnet Network

One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

1.2.7 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.2.8 BBMD

BACnet Broadcast Management Device (BBMD).A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

1.2.9 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

1.2.10 BAS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical support, control parameters, and daily operation. The BAS Owner for this project is Department of Homeland Security (DHS).

1.2.11 BIBBs

BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices.The “A” device uses data provided by the "B" device, or requests an action from the “B” device.

1.2.12 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

1.2.13 BI/BTL

BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

1.2.14 Bridge

Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

1.2.15 Broadcast

A message sent to all devices on a network segment.

1.2.16 Device

Any control system component, usually a digital controller, that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

1.2.17 Device Object

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

1.2.18 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and

BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported.

1.2.19 Digital Controller

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device".

1.2.20 Direct Digital Control (DDC)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

1.2.21 DDC System

A network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

1.2.22 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media.

1.2.23 Firmware

Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

1.2.24 Gateway

Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

1.2.25 Half Router

A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

1.2.26 Hub

A common connection point for devices on a network.

1.2.27 Internet Protocol (IP, TCP/IP, UDP/IP)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying

and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

1.2.28 Input/Output (I/O)

Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

1.2.29 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.

1.2.30 IP subnet

Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

1.2.31 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.2.32 LonTalk

CEA-709.1-C. A communication protocol developed by Echelon Corp. LonTalk is an optional physical and data link layer for BACnet.

1.2.33 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

1.2.34 Master-Slave/Token-Passing (MS/TP)

ISO 8802-3. One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

1.2.35 Native BACnet Device

A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

1.2.36 Network

Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®.

1.2.37 Network Number

A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

1.2.38 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

1.2.39 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

1.2.40 Object Properties

Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

1.2.41 Peer-to-Peer

Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

1.2.42 Performance Verification Test (PVT)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

1.2.43 PID

Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

1.2.44 PICS

Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

1.2.45 Points

Physical and virtual inputs and outputs. See also "Input/Output".

1.2.46 PTP

Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

1.2.47 Repeater

A network component that connects two or more physical segments at the physical layer.

1.2.48 Router

A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

1.2.49 Stand-Alone Control

Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS profile) communicating on a network with a parent device are exempt from stand-alone requirements.

1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

The paragraph specifies that all contract requirements of this section shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

1.4 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

a. Remove existing and provide new BACnet DDC systems including associated equipment and accessories. All new devices are accessible using a Web browser interface and communicate using ASHRAE 135 BACnet communications without the use of gateways, unless gateways are shown on the design drawings and specifically requested by the Government. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.

1.4.1 Design Requirements

1.4.1.1 Control System Drawings Title Sheet

Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings.

1.4.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria.

1.4.1.3 Control System Components List

Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number.For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

1.4.1.4 Control System Schematics

Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

a. Location of each input and output device

b. Flow diagram for each piece of HVAC equipment

c. Name or symbol for each control system component, such as V-1 for a valve

d. Setpoints, with differential or proportional band values

e. Written sequence of operation for the HVAC equipment

f. Valve and Damper Schedules, with normal (power fail) position

1.4.1.5 HVAC Equipment Electrical Ladder Diagrams

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

1.4.1.6 Component Wiring Diagrams

Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

1.4.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

1.4.1.8 BACnet Communication Architecture Schematic

Provide a schematic showing the project's entire BACnet communication network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks.

1.5 SUBMITTALS

Submit the in accordance to Section 01 33 00 – SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Include the following in the project's control system drawing set:

Control system drawings title sheet;

List of I/O Points;

Control System Components List;

Control system schematics;

HVAC Equipment Electrical Ladder diagrams;

Component wiring diagrams;

Terminal strip diagrams;

BACnet communication architecture schematic;

SD-03 Product Data

Direct Digital Controllers;

Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

BACnet Gateways;

Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

BACnet Protocol Analyzer;

Include capability to store and report data traffic on BACnet networks, measure bandwidth usage, filter information, and identify BACnet devices.

DDC Software;

Sensors and Input Hardware;

Output Hardware;

Surge and transient protection;

Indicators;

SD-05 Design Data

Performance Verification Testing Plan;

Pre-Performance Verification Testing Checklist;

SD-06 Test Reports

Performance Verification Testing Report;

SD-07 Certificates

Contractor's Qualifications;

SD-09 Manufacturer's Field Reports

Pre-PVT Checklist;

SD-10 Operation and Maintenance Data

Comply with requirements for data packages in DIVISION 01 - GENERAL REQUIREMENTS except as supplemented and modified in this specification.

BACnet Direct Digital Control Systems, Data Package 4;

Controls System Operators Manuals, Data Package 4;

SD-11 Closeout Submittals

Training documentation;

1.6 QUALITY ASSURANCE

1.6.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

1.6.2 Delivery, Storage, and Handling

Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6.3 Operating Environment

Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

1.6.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

1.6.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

1.6.6 Contractor's Qualifications

Submit documentation certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years.

1.6.7 Modification of References

The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

1.6.8 Project Sequence

The control system work for this project shall proceed in the following order:

a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."

b. Perform the control system installation work, including all field check-outs and tuning.

c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."

d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."

e. Submit and receive approval of the Performance Verification Testing Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."

f. Perform the Performance Verification Testing.

g. Submit and receive approval on the PVT Report.

h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL".

i. Deliver the final Controls System Operators Manuals.

j. Conduct Training.

k. Submit and receive approval of Closeout Submittals.

PART 2 PRODUCTS

2.1 DDC SYSTEM

a. Provide a networked DDC system for stand-alone control in compliance with the latest revision of the ASHRAE 135 BACnet standard. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet communications between the DDC system and native BACnet devices furnished with HVAC equipment. Devices provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing.

2.1.1 Direct Digital Controllers

Direct digital controllers shall be UL 916 rated.

2.1.1.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller.

2.1.1.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

2.1.1.3 Stand-Alone Control

Provide stand-alone digital controllers.

2.1.1.4 Internal Clock

Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.1.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power

source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

2.1.1.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.1.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

2.1.1.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

2.1.1.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.

b. Binary Inputs: Binary inputs shall have a toggle switch and monitor on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.

c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.

d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.

e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.

f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.

g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

2.1.1.10 Digital Controller BACnet Internetwork

Provide a BACnet internetwork with control products, communication media, connectors, repeaters, hubs, and routers. Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE 135, BACnet. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.

2.1.1.11 Communications Ports

a. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.

b. Telecommunications Interface Port: Provide one telecommunication port per building, permitting remote communication via point-to-point (PTP) protocol over telephone lines.

2.1.1.12 Modems

Provide v.92 modems where required for communication between the BACnet Operator Workstation (B-OWS) and the DDC system.

2.1.1.13 BACnet Gateways

Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Provide with each gateway an interoperability schedule showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

The following minimum capabilities are required:

a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.

b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.

c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.

d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.

e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.1.1.14 Digital Controller Cabinet

Provide each digital controller in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

2.1.1.15 Main Power Switch and Receptacle

Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

2.1.2 DDC Software

2.1.2.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

a. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.

b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.

c. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.

d. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

2.1.2.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

2.1.2.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

2.1.2.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

2.1.2.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

2.1.2.6 Timed Local Override

Provide an adjustable override time for each push of a timed local override button.

2.1.2.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

2.1.2.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

2.1.2.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out-Of-Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

2.1.2.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. When a computer workstation or web server is connected to the BACnet internetwork, alarms/events shall report to the computer, printer, alphanumeric pager, as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device and retrieved. Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

2.1.2.11 Trending

Provide BACnet trend services capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

The operator workstation shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification_Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the workstation and connected notebook computers.

2.1.2.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

2.1.2.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.1.3 BACnet Protocol Analyzer

Provide a BACnet protocol analyzer and required cables and fittings for connection to the BACnet network. The analyzer shall include the following minimum capabilities:

a. Capture and store to a file data traffic on all network levels.

b. Measure bandwidth usage.

c. Filtering options with ability to ignore select traffic.

2.2 SENSORS AND INPUT HARDWARE

Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

2.2.1 Field-Installed Temperature Sensors

Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2.2.1.1 Thermistors

Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.

2.2.1.3 Temperature Sensor Details

a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button with LED status indication, setpoint adjustment lever, without temperature display. Provide a hidden communication port or 802.11x wireless support for a portable operator interface like a notebook computer or PDA.

b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.

c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.

d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.

e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.2.2 Transmitters

Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

2.2.2.1 Relative Humidity Transmitters

Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

2.2.2.2 Pressure Transmitters

Provide transmitters integral with the pressure transducer.

2.2.3 Current Transducers

Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

2.2.4 Pneumatic to Electric Transducers

Pneumatic to electronic transducers shall convert a 0 to 20 psig signal to a proportional 4 to 20 mA or 0 to 10 VDC signal (operator scaleable). Supply voltage shall be 24 VDC. Accuracy and linearity shall be 1.0 percent or better.

2.2.5 Air Quality Sensors

Provide power supply for each sensor.

2.2.5.1 CO2 Sensors

Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

2.2.5.2 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and

calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.2.6 Input Switches

2.2.6.1 Timed Local Overrides

Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.2.7 Freeze Protection Thermostats

Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.2.8 Air Flow Measurement Stations

Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.2.9 Energy Metering

2.2.9.1 Electric Meters

Provide kilowatt-hour (kWh) meter(s) shown in accordance with NEMA/ANSI C12.10, suitable for the intended voltage, phases, and wye/delta configuration, with three current transformers and an output signal compatible with the DDC system.The meter shall have a box-mounted socket and an automatic circuit-closing bypass. Provide the meter with at least four pointer-type kWh registers, provisions for pulse initiation, and universal Class 2 indicating maximum kW demand register, sweep pointer indicating type, and a 15 minute interval. The meter accuracy shall be within plus or minus one percent of the actual kWh. Provide the correct multiplier on the meter face. Provide the current transformers in accordance with IEEE C57.13, with 600-volt insulation, and rated for metering with voltage, IL, momentary, and burden ratings coordinated with

the ratings of corresponding meters. Provide butyl-molded donut or window type transformers mounted on a bracket to allow secondary cables to connect to the transformer bushings. Provide wiring identification of the current transformer secondary feeders to permit field measurements to be taken with hook-on ammeters.

2.3 OUTPUT HARDWARE

2.3.1 Control Dampers

Provide factory manufactured galvanized steel dampers where indicated. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

Provide damper assembly frames constructed of 0.064 inch minimum thickness galvanized steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork subject to above 3-inch water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

Frames shall be at least 2 inches wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

The leakage rate of each damper when full-closed shall be no more than 4 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.3.2 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

2.3.2.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Thermal type actuators may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

2.3.3 Output Switches

2.3.3.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.4 ELECTRICAL POWER AND DISTRIBUTION

2.4.1 Transformers

Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

2.4.2 Surge and Transient Protection

Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.

b. The device shall react within 5 nanoseconds and automatically reset.

c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.

d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.

e. The primary suppression system components shall be pure silicon avalanche diodes.

f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.

g. The device shall have an indication light to indicate the protection components are functioning.

h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.

i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.

j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.

k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

2.4.2.2 Telephone and Communication Line Surge Protection

Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:

a. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.

b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.

c. The device shall be installed at the distance recommended by its manufacturer.

2.4.2.3 Controller Input/Output Protection

Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with DIVISION 26 - ELECTRICAL. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork.

2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.

b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

2.4.3.2 Analog Signal Wiring

Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair.Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

2.5 FIRE PROTECTION DEVICES

2.5.1 Duct Smoke Detectors

Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Provide UL listed or FM approved detectors, designed specifically for duct installation.

Furnish detectors under DIVISION 28 - ELECTRONIC SAFETY AND SECURITY and install under this section. Connect new detectors to the building fire alarm panel.

2.6 INDICATORS

2.6.1 Thermometers

Provide bi-metal type thermometers at locations shown. Thermometers shall have either 9 inch long scales or 3.5 inch diameter dials, with insertion, immersion, or averaging elements. Provide matching thermowells for pipe-mounted installations. Select scale ranges suitable for the intended service, with the normal operating temperature near the scale's midpoint. The thermometer's accuracy shall be plus or minus 2 percent of the scale range.

2.6.2 Pressure Gauges for Piping Systems

Provide pipe-mounted pressure gauges at the locations shown. Gauges shall conform to ASME B40.100 and have a 4-inch diameter dial and shutoff cock. Provide gauges in steam piping with a pressure snubber pigtail fitting. Select scale ranges suitable for the intended service, with the normal operating pressure near the scale's midpoint. The gauge's accuracy shall be plus or minus 2 percent of the scale range.

PART 3 EXECUTION

3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

3.1.1 BACnet Naming and Addressing

Coordinate with the BAS Owner and provide unique naming and addressing for BACnet networks and devices.

a. MAC Address

Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 00 to 64.

b. Network Numbering

Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object_Name" property names with plain-English descriptive names for each device
For example, the Device Object Name that for the device controlling the chiller plant at Building 3408 would be:

Device Object_Name = CW System B3408

A Device Object Name for a VAV box controller might be:

Device Object_Name = VAV BOX25

e. Object Name Property Text (Other than Device Objects)

The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

f. Object Identifier Property Number (Other than Device Objects)

Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

3.1.2 Minimum BACnet Object Requirements

a. Use of Standard BACnet Objects

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:
all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

Support and provide Description and/or Device_Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

Support and provide Inactive_Text and Active_Text property descriptions matching conditions shown on the points list.

e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

3.1.3 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

Priority Level	Application
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

b. Alarming

(1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.

(2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.

(3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

3.1.4 Local Area Networks

Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks.Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

3.1.5 BACnet Routers, Bridges, and Switches

Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an IP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment.

3.1.6 Wiring Criteria

a. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.

b. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.

c. Provide circuit and wiring protection required by NFPA 70.

d. Run all wiring located inside mechanical rooms in conduit.

e. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.

f. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination.

Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.

g. For controller power, provide new 120 VAC circuits, with ground. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.

h. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.

i. Grounding: Ground controllers and cabinets to a good earth ground as specified in DIVISION 26 - ELECTRICAL. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.

j. The Contractor shall be responsible for correcting all associated ground loop problems.

k. Run wiring in panel enclosures in covered wire track.

3.1.7 Accessibility

Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

3.1.8 Digital Controllers

a. Install as stand alone control devices (see definitions).

b. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

3.1.9 Hand-Off-Auto Switches

Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

3.1.10 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

3.1.10.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 54 inches above the floor to meet ADA requirements.

3.1.10.2 Duct Temperature Sensors

a. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.

b. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

3.1.10.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

3.1.10.4 Outside Air Temperature Sensors

Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

3.1.11 Energy Meters

Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

3.1.12 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

3.1.13 Thermometers and Gages

Mount devices to allow reading while standing on the floor or ground, as applicable.

3.1.14 Pressure Sensors

Locate pressure sensors as indicated.

3.1.15 Component Identification Labeling

Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

3.1.16 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 60 days advance notice of need.

3.2 TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING. This support shall include:

a. On-site operation and manipulation of control systems during the testing and balancing.

b. Control setpoint adjustments for balancing all relevant mechanical systems, including VAV boxes.

c. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.3 CONTROLS SYSTEM OPERATORS MANUALS

Provide one electronic and printed copy of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

a. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.

b. A copy of the project's mechanical design drawings, including any official modifications and revisions.

c. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."

d. A copy of the project's approved Performance Verification Testing Plan and Report.

e. A copy of the project's approved final TAB Report.

f. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.

g. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.

h. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.

i. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.

j. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.

k. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.

l. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

3.4 PERFORMANCE VERIFICATION TESTING (PVT)

3.4.1 General

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Government. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the BAS Owner.

3.4.2 Performance Verification Testing Plan

Submit a detailed PVT Plan of the proposed testing for Government approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be an clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project's sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the BAS Owner to acknowledge successful completion.

3.4.3 PVT Sample Size

Test all central plant equipment and primary air handling unit controllers unless otherwise directed. Twenty percent sample testing is allowed for identical controllers typical of terminal control like VAV boxes and fan coil units. The Government may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

The Government may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Government may choose which ones.

3.4.4 Pre-Performance Verification Testing Checklist

Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

b. Verify HVAC motors operate below full-load amperage ratings.

c. Verify all required control system components, wiring, and accessories are installed.

d. Verify the installed control system architecture matches approved drawings.

e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.

f. Verify all required surge protection is installed.

g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.

h. Verify all DDC network communications function properly, including uploading and downloading programming changes.

i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.

j. Verify each digital controller’s programming is backed up.

k. Verify all wiring, components, and panels are properly labeled.

l. Verify all required points are programmed into devices.

m. Verify all TAB work affecting controls is complete.

n. Verify all valve and actuator zero and span adjustments are set properly.

o. Verify all sensor readings are accurate and calibrated.

p. Verify each control valve and actuator goes to normal position upon loss of power.

q. Verify all control loops are tuned for smooth and stable operation. View trend data where applicable.

r. Verify each controller works properly in stand-alone mode.

s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.

t. Verify all electrical interlocks work properly.

u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook.

v. Verify the as-built (shop) control drawings are completed.

3.4.5 Conducting Performance Verification Testing

a. Conduct Government-witnessed PVT after approval of the PVT Plan and the completed Pre-PVT Checklist. Notify the Contracting Officer of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's

mechanical design drawings, the approved Pre-PVT Checklist, and the approved PVT Plan, conduct the PVT.

b. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.

c. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

3.4.6 Controller Capability and Labeling

Test the following for each controller:

a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.

b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.

c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network.

d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.

e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

3.4.7 Workstation and Software Operation

For every user workstation or notebook provided:

a. Show points lists agree with naming conventions.

b. Show that graphics are complete.

c. Show the UPS operates as specified.

3.4.8 BACnet Communications and Interoperability Areas

Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying

interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.

b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.

c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.

d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.

e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).

f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.

g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.

h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.

i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.

j. Device and Network Management: Show the following capabilities:

   (1) Display of Device Status Information

   (2) Display of BACnet Object Information

   (3) Silencing Devices that are Transmitting Erroneous Data

   (4) Time Synchronization

(5) Remote Device Reinitialization

(6) Backup and Restore Device Programming and Master Database(s)

(7) Configuration Management of Half-Routers, Routers and BBMDs

3.4.9 Execution of Sequence of Operation

Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

3.4.10 Control Loop Stability and Accuracy

For all control loops tested, give the Government trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

3.4.11 Performance Verification Testing Report

Upon successful completion of the PVT, submit a PVT Report to the Government and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

3.5 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location.

-- End of Section --

SECTION 23 81 00.00 20

UNITARY AIR CONDITIONING EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI DCUP	(Online) Directory of Certified Unitary Products
ANSI/AHRI 460	(2005) Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ANSI/ASHRAE 15 & 34	(2010; Addenda a, b, c, d, e, f, g, h, I, j, k, l, n and o; Errata 2011) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
ASHRAE 52.2	(2007; Addenda B 2008; Errata 2009, Errata 2010; INT 2010; Errata 2011) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 55	(2010; Errata 1 2011; Addenda A 2011) Thermal Environmental Conditions for Human Occupancy
ASHRAE 62.1	(2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D 520	(2000; R 2005) Zinc Dust Pigment

ASTM F 1040	(1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA MG 1	(2009) Motors and Generators

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-5541	(2006; Rev F) Chemical Conversion Coatings on Aluminum and Aluminum Alloys

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50502	(Basic) Air Conditioners, (Unitary Heat Pump), Air to Air (3,000 to 300,000 BTU)
FS OO-A-374	(Rev C) Air Conditioners with Remote Condensing Units or Remote Air-Cooled, and Water-Cooled Condenser Units, Unitary

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2009) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

UNDERWRITERS LABORATORIES (UL)

UL 1995	(2005; R 2009) Heating and Cooling Equipment
UL 873	(2007; Reprint Jan 2010) Standard for Temperature-Indicating and -Regulating Equipment
UL 900	(2004; Reprint Nov 2009) Standard for Air Filter Units

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control system wiring diagrams

SD-03 Product Data

Condensing Units

Heat pumps, air to air

Air conditioners

Submit documentation for Energy Star qualifications or meeting FEMP requirements. Indicate Energy Efficiency Rating. For packaged terminal units, include indoor noise rating.

Filters

Thermostats

SD-06 Test Reports

Start-up and initial operational tests

SD-08 Manufacturer's Instructions

Heat pumps, air to air

Condensing Units

Air conditioners

Filters

Thermostats

SD-10 Operation and Maintenance Data

Condensing Units

Heat pumps, air to air,

Air conditioners,

Filters,

Thermostats,

Submit in accordance with DIVISION 01 - GENERAL REQUIREMENTS.

SD-11 Closeout Submittals

Posted operating instructions

1.4 QUALITY ASSURANCE

1.4.1 Modification of References

Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Contracting Officer.

1.4.2 Detail Drawing

For refrigerant piping, submit piping, including pipe sizes. Submit control system wiring diagrams.

1.4.3 Safety

Design, manufacture, and installation of unitary air conditioning equipment shall conform to ANSI/ASHRAE 15 & 34.

1.4.4 Posted Operating Instructions

Submit posted operating instructions for each packaged air conditioning unit.

1.4.5 Sizing

Size equipment based on Design Manual CS from the Air Conditioning Contractors of America; do not oversize.

1.5 REFRIGERANTS

Refrigerants shall have an Ozone Depletion Factor (ODF) of 0.05 or less. The ODF shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Programme. CFCs and HCFCs and Halons shall not be permitted. Refrigerant shall be an approved alternative refrigerant per EPA's Significant New Alternative Policy (SNAP) listing.

1.6 ENVIRONMENTAL REQUIREMENTS

For proper Indoor Environmental Quality, maintain positive pressure within the building. Ventilation shall meet or exceed ASHRAE 62.1 and all published addenda. Meet or exceed filter media efficiency as tested in accordance with ASHRAE 52.2. Thermal comfort shall meet or exceed ASHRAE 55.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Local/Regional Materials

See Division 01 - for Sustainable Design Requirements.

1.7.2 Environmental Data

See Division 01 for Environmental Requirements.

PART 2 PRODUCTS

2.1 CONDENSING UNITS

Each remote condenser coil shall be fitted with a manual isolation valve and an access valve on the coil side. Saturated refrigerant condensing temperature shall not exceed 120 degrees F at 95 degrees F ambient. Unit shall be provided with low ambient condenser controls to ensure proper operation in an ambient temperature of 0 degrees F. Fan and cabinet construction shall be provided as specified in paragraph "Unitary Equipment Components". Fan and condenser motors shall have open enclosed enclosures.

2.1.1 Energy Performance

Energy performance shall be in accordance with CID A-A-50502 and schedules on plans.

2.1.2 Air-Cooled Condenser

Unit shall be rated in accordance with ANSI/AHRI 460 and conform to the requirements of UL 1995. Unit shall be factory fabricated, tested, packaged, and self-contained. Unit shall be complete with casing, propeller or centrifugal type fans, heat rejection coils, connecting piping and wiring, and all necessary appurtenances.

2.1.2.1 Connections

Interconnecting refrigeration piping, electrical power, and control wiring between the condensing unit and the indoor unit shall be provided as required and as indicated. Electrical and refrigeration piping terminal connections between condensing unit and evaporator units shall be provided.

2.2 HEAT PUMPS, AIR TO AIR

CID A-A-50502, except as modified in this article; Type II, Class 18r2. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the ARI Directory, a letter of certification from ARI that the units have been certified and will be listed in the next Directory will be acceptable. Provide factory assembled units complete with accessories, wiring, piping, and controls. Provide units with outlet grilles, supplemental electric heaters, humidifiers, and air filters as specified in the paragraph entitled "Filters." Units shall be provided with low ambient operation condenser controls to ensure proper operation in an ambient temperature of 0 degrees F.

2.2.1 Energy Performance

Energy performance shall be in accordance with CID A-A-50502 schedules on plans.

2.2.2 Air Coils

Extended-surface fin and tube type with seamless copper or aluminum tubes with copper or aluminum fins securely bonded to the tubes. On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a coating on outdoor air and indoor air coils as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.2.3 Compressors

For compressors above 20 tons, compressor speed shall not exceed 3450 rpm. For equipment over 10 tons, provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have a means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shutdown by safety controls. Provide reciprocating compressors with crankcase heaters, and vibration isolators.

2.2.4 Mounting Provisions

Provide units that permit mounting as indicated. Provide suitable lifting attachment plates to enable equipment to be lifted to normal position.

2.2.5 Temperature Controls

Provide controls as specified in CID A-A-50502 and as modified herein. Provide indoor thermostats of the adjustable type that conform to applicable requirements of UL 873. Provide manual means for temperature set-back. Provide thermostats capable of controlling supplemental heat as specified in CID A-A-50502. Provide a manual selector switch or other means to permit the supplementary heater to be energized when the heat pump compressor and associated equipment are inoperative. Control supplementary heater with the room thermostat while bypassing the outdoor thermostat. Locate switch adjacent to or as an integral part of the room thermostat. An indicator light on the room thermostat or manual heat switch shall indicate when supplementary heaters are operating.

2.2.6 Accessories

In addition to accessories specified in CID A-A-50502, provide the following accessories for heat pump units.

a. Protective grille around outside unit coils

2.3 AIR CONDITIONERS

2.3.1 Split-System Type

FS OO-A-374, except as modified herein; Type I, Style A, B & C, Class 1. Additional requirements for various system components are specified in this paragraph; however, basic requirements for the system and system components

are contained in FS OO-A-374. Provide separate assemblies designed to be used together. Base ratings on the use of matched assemblies. Provide performance diagrams for units with capacities not certified by ARI to verify that components of the air conditioning system furnished will satisfy the capacity requirement specified or indicated. Minimum energy efficiency shall be in accordance with ASHRAE 90.1 - IP, at a minimum or in accordance with schedules on plans. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the ARI Directory, a letter of certification from ARI that units have been certified and will be listed in the next Directory will be acceptable. Provide capacity, electrical characteristics and operating conditions as indicated. Condensers shall provide not less than 10 degrees F liquid subcooling at standard ratings.

2.3.2 Single Zone Units

Provide single zone type units arranged to draw or blow through coil sections. Air may be blown or drawn through heating section.

2.3.3 Heaters

Provide as an integral part of the evaporator-blower unit.

2.3.4 Compressors

For compressors over 20 tons, compressor speed shall not exceed 3450 rpm. For systems over 10 tons provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multi- or variable speed compressors, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shut down by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes. Provide a pumpdown cycle for units 20 tons and over. Provide reciprocating compressors with crankcase heaters in accordance with the manufacturer's recommendations. If compressors are paralleled, provide not less than two independent circuits.

2.3.5 Coils

On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation. Provide a coating on condenser and evaporator coils and fins as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.3.6 Condenser Controls

Provide start-up and head pressure controls to allow for system operation at ambient temperatures down to 0 degrees F.

2.3.7 Fans

Provide belt-driven evaporator fans with adjustable pitch pulleys; except for units less than 5 ton capacity, direct drive with at least two speed taps may be used. Select pulleys at approximately midpoint of the adjustable range.

2.3.8 Filters

Provide filters of the type specified in this section.

2.3.9 Filter Boxes

Provide when filters are not included integral with air conditioning units. Construct of not less than No. 20 US gage steel with track, hinged access doors with latches, and gaskets between frame and filters. Arrange filters to filter outside and return air. Provide removable filter assemblies, replaceable without the use of tools.

2.3.10 Mixing Boxes

Provide of the physical size to match the basic unit and include equal sized flanged openings, sized to individually handle full air flow. Arrange openings as indicated. Provide openings with dampers of parallel or opposed blade type. Provide opposed blade type for modulating dampers and parallel type for two-position dampers. Connect damper shafts together by one continuous linkage bar. Arrange dampers for manual operation so that when one starts to close from its opened position, the other starts to open from its closed position.

2.3.11 Thermostats

Provide adjustable type that conforms to applicable requirements of UL 873. Provide combination heating-cooling type with contacts hermetically sealed against moisture, corrosion, lint, dust, and foreign material. Design to operate on not more than 1.5 degrees Fdifferential and of suitable range calibrated in degrees F. Provide adjustable heat anticipation and fixed cooling anticipation. Provide two independent temperature sensing elements electrically connected to control the compressor and heating equipment, respectively. Accomplish manual switching for system changeover from heating to cooling or cooling to heating and fan operation through the use of a thermostat subbase. Provide system selector switches to provide "COOL" and "OFF" and "HEAT" and fan selector switches to provide "AUTOMATIC" and "ON." Provide relays, contactors, and transformers located in a panel or panels for replacement and service.

2.3.11.1 Cooling

a. When thermostat is in "COOL" position with fan selector switch in "AUTO" position, compressor, evaporator fan, and condenser fan shall cycle together.

b. When thermostat is in "COOL" position with fan selector switch in "ON" position, compressor, and condenser fan shall cycle together and evaporator fan shall run continuously.

2.3.11.2 Heating

a. When thermostat is in "HEAT" position with fan selector switch in "AUTO" position, heater and supply air fan shall cycle together. Provide a separate thermostat to keep the fan running until the heater cools.

b. When thermostat is in "HEAT" position with fan selector switch in "ON" position, heater shall cycle and supply air fan shall run continuously.

2.3.11.3 Supply Air Fan

a. When fan selector switch is in "AUTO" position with thermostat in "OFF" position, fan shall not run.

b. When fan selector switch is in "ON" position, fan shall run continuously.

2.4 FILTERS

Provide filters to filter outside air and return air and locate inside air conditioners. Provide replaceable (throw-away) type. Filters shall conform to UL 900, Class 2. Polyurethane filters shall not be used on units with multiframe filters.

2.4.1 Replaceable Type Filters

ASTM F 1040 throw-away frames and media, standard dust holding capacity, 350 fpm maximum face velocity, and 2 inches thick. Filters shall have a minimum efficiency reporting value (MERV) of 8 when tested in accordance with ASHRAE 52.2.

2.5 FINISHES

2.5.1 Factory Coating

2.5.1.1 Equipment and Components

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 125 hours exposure to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type 1.

2.5.2 Chemical Conversion Coating with Polyelastomer Finish Coat

Dip coils in a chemical conversion solution to molecularly deposit a corrosion resistant coating by electrolysis action. Chemical conversion coatings shall conform to MIL-DTL-5541, Class 1A.Cure conversion coating at a temperature of 110 to 140 degrees F for a minimum of 3 hours. Coat coil surfaces with a complex polymer primer with a dry film thickness of 1 mil. Cure primer coat for a minimum of 1 hour. Using dip tank method, provide three coats of a complex polyelastomer finish coat. After each of the first two finish coats, cure the coils for 1 hour. Following the third

coat, spray a fog coat of an inert sealer on the coil surfaces. Total dry film thickness shall be 2.5 to 3.0 mils. Cure finish coat for a minimum of 3 hours. Coating materials shall have 300 percent flexibility, operate in temperatures of minus 50 to plus 220 degrees F, and protect against atmospheres of a pH range of 1 to 14.

2.6 MOTORS AND STARTERS

NEMA MG 1, NEMA ICS 1, and NEMA ICS 2. Variable speed. Motors less than 1 hp shall meet NEMA High Efficiency requirements. Motors 1 hp and larger shall meet NEMA Premium Efficiency requirements. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide general-purpose type starter enclosures in accordance with NEMA ICS 6.

2.7 REFRIGERANT PIPING

Refrigerant piping for split-system unitary equipment shall be provided and installed in accordance with Section 23 23 00 REFRIGERANT PIPING.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

3.1.1 Unitary Air Conditioning System

Install as indicated, in accordance with requirements of ANSI/ASHRAE 15 & 34, and the manufacturer's installation and operational instructions.

3.2 AUXILIARY DRAIN PANS, DRAIN CONNECTIONS, AND DRAIN LINES

Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment where condensate overflow will cause damage to ceilings, piping, and equipment below. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.3 ACCESS PANELS

Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.4 AIR FILTERS

Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air.

3.5 FLASHING AND PITCH POCKETS

Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls in accordance with Section 07 60 00 FLASHING AND SHEET METAL.

3.6 IDENTIFICATION TAGS AND PLATES

Provide equipment, gages, thermometers, valves, and controllers with tags numbered and stamped for their use. Provide plates and tags of brass or suitable nonferrous material, securely mounted or attached. Provide minimum letter and numeral size of 1/8 inch high.

3.7 FIELD QUALITY CONTROL

3.7.1 Start-Up and Initial Operational Tests

Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

3.7.2 Performance Tests

Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, test the systems to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, record readings hourly. At the end of the test period, average the readings, and the average shall be considered to be the system performance.

3.8 WASTE MANAGEMENT

Separate waste in accordance with the Waste Management Plan, placing copper materials in designated areas for reuse. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

-- End of Section --

SECTION 23 82 00.00 20

TERMINAL HEATING UNITS

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 117	(2007) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM D 1654	(2005) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2006) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 54	(2006) National Fuel Gas Code
NFPA 70	(2007) National Electrical Code - 2008 Edition
NFPA 90A	(2002; Errata 2003; Errata 2005) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2006) Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	(2004) Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Unit heaters;

Infrared heaters;

SD-10 Operation and Maintenance Data

Unit heaters,

Infrared heaters

PART 2 PRODUCTS

2.1 UNIT HEATERS

Self-contained and factory assembled, propeller or centrifugal fan with capacities expressed as Btu per hour output and cubic foot-per-minute air delivery, operating conditions, and mounting arrangements as indicated. Average fan bearing life shall be minimum 200,000 hours at operating conditions. Provide fan motor with direct or belt drive. Construct fan-guard motor mount of steel wire. Equip each heater with individually adjustable package discharge louver. Provide thermostats as indicated. Furnish circuit breaker disconnect switch.

2.1.1 Electric Unit Heater

UL listed; wattage, voltage, phase, and number of steps as indicated. Provide control-circuit terminals and single source of power supply. Heater 5 Kw and larger shall be three-phase, with load balanced on each of the three phases. Limit leaving air temperature below 140 degrees F at 60 degrees F entering air.

2.1.1.1 Casing

Minimum 21 gage steel.

2.1.1.2 Heating Element

Nickel-chromium heating wire element, free from expansion noise and 60 Hz hum. Embed element in magnesium-oxide insulating refractory. Seal element in high-mass steel or corrosion-resisting metallic sheath with fins. Enclose element ends in terminal box. Space fins at maximum six fins per inch. Limit fin surface temperature 550 degrees Fat any point during normal operation.

2.1.1.3 Controls

Include limit controls for thermal overheat protection of heaters. For remote thermostatic operation, provide contactor rated for 100,000 duty cycles. Provide a control transformer to supply 120-volt thermostat control circuit for each heater. Provide room thermostat for pilot duty.

2.1.1.4 Wiring

Completely factory-prewired to terminal strips, ready to receive branch circuit and control connections for 140 degrees Faluminum wiring.

2.1.1.5 Accessories

Provide fan switching devices to independently operate fan motor for summer ventilation and winter heat recovery.

2.2 INFRARED HEATERS

Reflector-beam spread and operating conditions as indicated. Provide pre-wired control boxes, thermostats, reflector and duct hangers.

2.2.1 Electric Infrared Heater

Self-contained, factory assembled, and UL listed and including the heating element, reflector, heater housing, mounting brackets, element holders, wire guards, and high-temperature internal wiring.

2.2.1.1 Heating Element

Minimum 3/8 inch diameter quartz tube or metal sheath with coiled resistor wire. Element operating temperature range shall be 1200 to 1800 degrees F.

2.2.1.2 Heater Housing

Weatherproof stainless-steel construction. Provide a baked enamel finish over a corrosion-resistant primer. Provide a chrome-plated or stainless-steel wire guard to prevent heating elements from accidental damage. Furnish swivel brackets to position heater in any horizontal angle.

2.2.1.3 Reflector

Polished stainless steel.

2.2.1.4 Wiring

Fully enclosed internal wiring. Provide minimum 24 inchslack fixture (heater) wire for connection to branch circuit wiring.

2.3 SOURCE QUALITY CONTROL

Protect equipment items by manufacturers' corrosion-inhibiting coating or paint system that has proved capable of withstanding salt-spray test in accordance with ASTM B 117. Test indoor and outdoor equipment for 125 hours; test outdoor equipment used in a marine atmosphere for 500 hours. For each specimen, perform a scratch test as defined in ASTM D 1654.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment where indicated and as recommended by manufacturer's recommendations, NFPA 54, NFPA 90A, NFPA 90B, NFPA 91 and NFPA 211.

3.1.1 Suspensions of Equipment

Provide equipment supports including beam clamps, turnbuckles and twist links or weld-wire chains, wire ropes with rope clips and rope thimbles, threaded-eye rod hangers with lock nuts and heat-duct hangers, threaded-eye bolts with expansion screws, brackets, platform and mounting frame, and vibration isolators.Locate equipment in such a manner that working space is available for servicing, such as vacuum pump and burner removal, access to automatic controls, and lubrication. Provide electrical isolation of dissimilar metals. Clean interior of casings or cabinets before and after completion of installation.

3.1.2 Electrical Work

NFPA 70 and Division 16, "Electrical Work." When replacing original control wires, provide No. 16 AWG with minimum 105 degrees C insulation.

3.2 FIELD QUALITY CONTROL

Administer, schedule, and conduct specified tests. Furnish personnel, instruments and equipment for such tests. Correct defects and repeat the respective inspections and tests. Conduct inspections and testing in the presence of the Contracting Officer's Technical Representative.

3.2.1 Test Instruments and Apparatus

Provide instruments and apparatus currently certified as being accurate to within one percent of their full scale. Use gages with a maximum scale between 1 1/2 and 2 times test pressure.

3.2.2 Field Inspection

Prior to initial operation, inspect equipment installation to ensure that indicated and specified requirements have been met.

3.2.3 Field Tests

3.2.3.1 Insulation-Resistance Tests for Electrical Equipment

At the completion of wiring, test 600 volt wiring to verify that no short circuits exist before or after the attachment of electrical heating equipment to the power source. Make tests with an instrument which applies a voltage of approximately 500 volts for a direct reading of insulation resistance.

3.2.3.2 Operational Tests

After completing fire tests and insulation-resistance tests, operate equipment continuously under varying load conditions to verify functioning of combustion controls, electrical controls, flame safeguard controls, safety interlocks, and specified operating sequence. Run each test for a minimum period of one hour.

-- End of Section --

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. This section applies to all sections of Division 26, ELECTRICAL, of this project specification unless specified otherwise in the individual sections.This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM
Section 26 23 00 SWITCHBOARDS AND SWITCHGEAR
Section 26 51 00 INTERIOR LIGHTING
Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment

operations and that refer to this section for detailed description of submittal types.

c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 480/277 volts, three phase, four wire service to the main switchboard. The switchboard will supply the 480/277 volt distribution panelboards, which in turn supply dry type stepdown transformers and their associated 208/120 volt and 240/120 volt panelboards.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

When required by a task order, include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial

market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.

1.6.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

When required by a task order, provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.12 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in the task order, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the task order.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements specified in the technical sections.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS the section specifying the associated electrical equipment.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

-- End of Section --

26 08 16

COMMISSIONING OF ELECTRICAL SYSTEMS SUPPORT

PART 1 GENERAL

1.1 SCOPE OF ELECTRICAL SUPPORT

A. The purpose of this section is to specify Division 26, 27 and 28 responsibilities and participation in the commissioning process if commissioning services are specifically required by a task order.

B. The Owner has established a Commissioning Authority (CxA) to oversee certain commissioning activities on this project. While the CxA has the overall responsibility for planning and coordinating the commissioning process, all parties participate. This includes the owner, construction manager, facility operator, architect, engineer, general contractor, subcontractors, specialty subcontractors, equipment suppliers, vendors, building authorities and others entities as required.

C. If required by a task order, the General Contractor and all Subcontractors shall designate one person to represent their own company as the full-time Lead Commissioning Coordinator. Each Lead Commissioning Coordinator shall participate as a member of the Commissioning Authority's 'Commissioning Team'. The General Contractor and each Subcontractor shall also designate a backup person to represent their company and fill the role as Lead Commissioning Coordinator and participate as a member of the CxA Commissioning Team when there are absences.

D. Commissioning and coordination with the Commissioning Authority are the responsibility of the Contractor (including subcontractors and vendors). The Contractor is responsible for providing all scheduling, coordination and support required for start-up, testing, and commissioning (see Division 01). The General Commissioning Requirements Section 01 19 13 is intended to provide an indication of the systems which are to be commissioned by the Contractor prior to and including verification by the Owner's Representative. The commissioning process requires Division 26, 27 and 28 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner.

E. Work of Divisions 26, 27, and 28 include the following:

1. Attend commissioning scoping meetings. Equipment vendor representatives shall also attend upon request of the Commissioning Authority. These meetings shall further define the testing requirements and participation of each contractor and sub-contractors for each commissioning activity.

2. Attend commissioning meetings as required to facilitate the commissioning process.

3. Provide Commissioning Authority additional requested data, prior to normal O&M Manual submittal, in a timely manner for the development of the pre-functional and functional performance testing procedures.

4. During the normal submittal processes, provide an additional copy of all equipment submittals, startup forms, field static testing reports (Circuit breaker test report, Megger test reports, Torque testing reports, etc.) to the Commissioning Authority for review.

5. The Electrical Prime Contractor shall be responsible for development of a comprehensive startup plan. The startup plan shall be developed with the help of the Commissioning Authority in order to integrate startup activities with the Commissioning Authority's commissioning plan.

6. The Commissioning Authority shall prepare the Pre-Functional Checklists (PFC) and Functional Performance Test (FPT) checklists. The PFC & FPT checklists shall be completed after equipment submittals have been reviewed, and then distributed the Contractor.

7. Provide skilled technicians, including equipment vendor representatives, equipment, and materials to perform pre-functional testing and execute functional performance tests.

8. Correct deficiencies found during startup and functional performance testing in a timely manner to facilitate retesting activities within the commissioning schedule.

9. Submit the completed Pre-Functional Checklists to General Contractor, and Commissioning Authority to verify pre-functional requirements are fulfilled before functional performance testing for the associated equipment or system is scheduled to start. Refer to Section "01 91 13 - General Commissioning Requirements," for commissioning procedure detail. Startup documentation shall also be required from as a prerequisite to functional performance testing.

10. Maintain and update as-built drawings during construction.

11. Provide final O&M manuals that incorporate all system changes.

12. Providing training, for equipment and systems specified under this section, with coordination by the Contractor and Owner's Representative

1.2 RELATED WORK

A. Division 01 Section 01 91 13 General Commissioning Requirements.

B. Division 26 Electrical.

C. Division 27 Communications

D. Cooperate with the Mechanical contractor in the following manner:

1. Provide necessary power to allow mechanical equipment start up to be accomplished according to the master schedule.

2. Provide labor and material to make corrections when required, without undue delay.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide test equipment as necessary for start-up and commissioning of the electrical equipment and systems.

B. Proprietary test equipment required by the electrical equipment manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall demonstrate its use and assist the Contractor in the commissioning process.

PART 3 EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so each system can be started, tested, and otherwise commissioned. Division 28 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are fully functional. This includes the complete installation of all equipment, materials, conduit, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.

B. A commissioning plan will be developed by the Commissioning Authority and approved by the Owner's Representative.

1. Division 28 shall be obligated to assist the Commissioning Authority in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation, identification of electrical commissioning support person, parties responsible for startup activities, and schedule dates for equipment startup activities.

2. If system modifications/clarifications are called for in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.

3. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner's Representative for approval.

3.2 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up all systems within Division 28.

1. These same technicians shall be made available to assist the Contractor and Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty.

2. Work schedules, time required for testing, etc., will be requested and coordinated by the Contractor.

3. Division 28 will ensure that qualified technician(s) are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustment, and problem resolutions.

B. System problems and discrepancies may require additional technician time which shall be made available for the subsequent commissioning periods until required system performance is obtained.

C. The Owner's Representative reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Such qualifications include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Contractor to get the job done.

3.3 WORK TO RESOLVE DEFICIENCIES

A. In some systems, misadjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Owner's Representative and the Architect, with input from the Contractor and equipment supplier. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the work needed to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problem in an expeditious manner will be the Contractor's responsibility.

3.4 RETESTING AND RECOMMISSIONING

Any fault in material or in any part of the installation revealed by commissioning tests shall be investigated, replaced, or repaired by the Contractor, and the same test repeated at the Contractor's expense until no fault appears.

3.5 TRAINING

A. Participate in the training of the Owner's engineering and maintenance staff, as required in Divisions 01 and 28, on each system and related components. Training, in part, will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.

B. Training shall be conducted jointly by the Contractor, the Design Engineers, and the equipment vendors. The Contractor will be responsible for highlighting system peculiarities specific to this project.

-- End of Section --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012) National Electrical Safety Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2005) American National Standard for Electrical Metallic Tubing (EMT)
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FU 1	(2002; R 2007) Low Voltage Cartridge Fuses

NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2010) Terminal Blocks
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2009) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(1992; R 1997) Standard for Dry-Type Transformers for General Applications
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2004) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA TP 1	(2002) Guide for Determining Energy Efficiency for Distribution Transformers
NEMA VE 1	(2009) Standard for Metal Cable Tray Systems
NEMA WD 1	(1999; R 2005; R 2010) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2002; R 2008) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2007; Errata 2007) American National Standard for Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

NFPA 70E	(2012) Standard for Electrical Safety in the Workplace
NFPA 780	(2011) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA J-STD-607	(2002a) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
TIA-568-C.1	(2009) Commercial Building Telecommunications Cabling Standard
TIA-569	(2004b; Add 1 2009) Commercial Building Standard for Telecommunications Pathways and Spaces

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Jul 2007) Standard for Flexible Metal Conduit
UL 1063	(2006) Machine-Tool Wires and Cables
UL 1242	(2006; Reprint Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1449	(2006; Reprint Feb 2011) Surge Protective Devices
UL 1561	(2011) Dry-Type General Purpose and Power Transformers
UL 1569	(1999; Reprint Jun 2009) Standard for Metal-Clad Cables
UL 198M	(2003; Reprint Oct 2007) Standard for Mine-Duty Fuses
UL 20	(2010) General-Use Snap Switches
UL 2043	(2008) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 360	(2009; Reprint Jun 2009) Liquid-Tight Flexible Steel Conduit

UL 4248	(2007) UL Standard for Safety Fuseholders
UL 44	(2010) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2003; Reprint Feb 2010) Wire Connectors
UL 486C	(2004; Reprint Feb 2010) Splicing Wire Connectors
UL 489	(2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2001; Reprint Apr 2010) Attachment Plugs and Receptacles
UL 5	(2004; Reprint Jul 2010) Surface Metal Raceways and Fittings
UL 50	(2007) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 508	(1999; Reprint Apr 2010) Industrial Control Equipment
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2004; Reprint Apr 2010) Metallic Outlet Boxes
UL 514B	(2004; Reprint Nov 2009) Conduit, Tubing and Cable Fittings
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 651	(2005; Reprint Mar 2010) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 67	(2009; Reprint Sep 2010) Standard for Panelboards
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 817	(2001; Reprint Oct 2009) Standard for Cord Sets and Power-Supply Cords

UL 83	(2008) Thermoplastic-Insulated Wires and Cables
UL 870	(2008) Standard for Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2006; Reprint May 2010) Ground-Fault Circuit-Interrupters
UL 96A	(2007) Standard for Installation Requirements for Lightning Protection Systems
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards

Transformers;

Cable trays;

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

Wireways;

SD-03 Product Data

Receptacles;

Circuit breakers;

Switches;

Transformers;

Enclosed circuit breakers;

Motor controllers Combination

motor controller;

Manual motor starters;

CATV outlets;

Telecommunications Grounding Busbar;

Surge protective devices;

Submittals shall include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test;

Grounding system test;

Transformer tests;

Ground-fault receptacle test;

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2,UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40(40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Steel compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.3 SURFACE RACEWAY

2.3.1 Surface Metal Raceway

UL 5, two-piece painted steel, totally enclosed, snap-cover type. Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Receptacles shall be as specified herein and shall be spaced minimum of one every 18 inches.

2.4 CABLE TRAYS

NEMA VE 1. Cable trays shall form a wireway system, and shall be of nominal 3 inch depth. Cable trays shall be constructed of aluminum, copper-free aluminum or steel that has been zinc-coated after fabrication. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius.

2.4.1 Basket-Type Cable Trays

Provide size as indicated with maximum wire mesh spacing of 2 by 4 inch.

2.4.2 Cantilever

Cantilever-type, center-hung cable trays may be provided at the Contractor's option in lieu of other cable tray types specified.

2.5 OPEN TELECOMMUNICATIONS CABLE SUPPORT

2.5.1 Open Top Cable Supports

Provide open top cable supports in accordance with UL 2043. Open top cable supports shall be galvanized or zinc-coated steel.

2.5.2 Closed Ring Cable Supports

Provide closed ring cable supports in accordance with UL 2043. Closed ring cable supports shall be steel.

2.6 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.6.1 Outlet Boxes for Telecommunications System

Provide standard type 4 11/16 inches square by 2 1/4 inches deep. Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend radii.

2.7 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.8 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.8.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and capacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.8.1.1 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.8.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

2.8.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.8.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.8.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with TIA J-STD-607. The TBB shall be a minimum No. 6 AWG and be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG. 2.8.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the telecommunications main grounding busbar (TMGB) and the electrical service ground in accordance with TIA J-STD-607. The bonding conductor for telecommunications shall be sized the same as the TBB.

2.8.5 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.8.6 Cable Tray Cable or Power Limited Tray Cable

UL listed; type TC or PLTC.

2.8.7 Cord Sets and Power-Supply Cords

UL 817.

2.9 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.10 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Plates on finished walls shall be nylon or lexan, minimum 0.03 inch wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.11 SWITCHES

2.11.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Handles shall be ivory thermoplastic. Wiring terminals shall be screw-type, side-wired or of the solderless pressure type having suitable conductor-release arrangement. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.11.2 Switch with Red Pilot Handle

NEMA WD 1. Provide pilot lights that are integrally constructed as a part of the switch's handle. The pilot light shall be red and shall illuminate whenever the switch is closed or "on". The pilot lighted switch shall be rated 20 amps and 120 volts or 277 volts as indicated. Provide the circuit's neutral conductor to each switch with a pilot light.

2.11.3 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

2.11.4 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 1, enclosure or as indicated, per NEMA ICS 6.

2.12 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch . Time-current characteristics curves of fuses serving motors or connected in

series with circuit breakers shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

2.12.1 Fuseholders

Provide in accordance with UL 4248.

2.12.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 198M, Class RK-1 or RK-5. Associated fuseholders shall be Class R only.

2.12.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 198M, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.12.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 198M, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.13 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory as per NEMA WD 1. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double or triple-wipe ground contacts.

2.13.1 Switched Duplex Receptacles

Provide separate terminals for each ungrounded pole. Top receptacle shall be switched when installed.

2.13.2 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

2.13.3 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFCI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.13.4 Special Purpose Receptacles

Provide in NEMA configuration indicated. Furnish one matching plug with each receptacle.

2.13.5 Plugs

Provide heavy-duty, rubber-covered three-wire cord of required size, install plugs thereon, and attach to equipment. Plugs shall be UL listed with receptacles, complete with grounding blades. Where equipment is not available, turn over plugs and cord assemblies to the Government.

2.14 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards shall be circuit breaker-equipped unless indicated otherwise. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" or "below" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Provide new directories for existing panels modified by this project as indicated. Type directories and mount in holder behind transparent protective covering. Panelboard shall have nameplates in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.14.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gauge if flush-mounted or mounted outdoors, and not less than No. 12 gauge if surface-mounted indoors, with full seam-welded box ends. Cabinets shall be painted in accordance with paragraph PAINTING. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch. Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets.

2.14.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.14.2.1 Panelboard Neutrals for Non-Linear Loads

UL listed, and panelboard type shall have been specifically UL heat rise tested for use on non-linear loads. Panelboard shall be heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing. Verification of the testing procedure shall be provided upon request. Two neutral assemblies paralleled together with cable is not acceptable. Nameplates for panelboard rated for use on non-linear loads shall be marked "SUITABLE FOR NON-LINEAR LOADS"and shall be in accordance with paragraph FIELD FABRICATED NAMEPLATES. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.14.3 Circuit Breakers

Shall be as specified in Section 26 28 01.00 COORDINATED POWER SYSTEM PROTECTION.

2.15 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

2.16 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs); shall conform to UL 508 and UL 489 and shall be provided as shown. MSCPs shall consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. MSCPs shall be rated in accordance with the requirements of NFPA 70.

2.17 TRANSFORMERS

NEMA ST 20, general purpose, dry-type, self-cooled, ventilated. Provide transformers in NEMA 1 enclosure. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 115 degrees C temperature rise shall be capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.17.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, shall be energy efficient type. Minimum efficiency, based on factory test results, shall not be less than NEMA Class 1 efficiency as defined by NEMA TP 1.

2.17.2 Transformers With Non-Linear Loads

Transformer insulation shall be a UL recognized 220 degrees C system. Neither the primary nor the secondary temperature shall exceed 220 degrees C at any point in the coils while carrying their full rating of non-sinusoidal load. Transformers are to be UL listed and labeled for K-9 in accordance with UL 1561. Transformers evaluated by the UL K-Factor evaluation shall be listed for 115 degrees C average temperature rise only. Transformers with K-Factor ratings with temperature rise of 150 degrees C rise shall not be acceptable. K-Factor rated transformers shall have an impedance range of 3 percent to 5 percent, and shall have a minimum reactance of 2 percent to prevent excessive neutral current when supplying loads with large amounts of third harmonic.

2.18 MOTORS

NEMA MG 1; hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Unless otherwise indicated, motors rated 1 HP and above shall be continuous duty type.

Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.18.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.18.2 Premium Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10. In addition, continuous rated, polyphase squirrel-cage medium induction motors shall meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.18.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-

loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.18.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment as specified herein. Power wiring and conduit shall conform to the requirements specified herein. Control wiring shall be provided under, and conform to the requirements of the section specifying the associated equipment.

2.19 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position. Minimum short circuit withstand rating of combination motor controller shall match electrical equipment feeding controller.

2.19.1 Control Wiring

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual

conductors of each external cable to be terminated on adjacent terminal points.

2.19.2 Control Circuit Terminal Blocks

NEMA ICS 4.Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.19.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.19.3 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder. One secondary lead shall be fused; other shall be grounded.

2.19.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.19.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers shall have compelling relays and shall be multiple-button, station-type with pilot lights for each speed.

2.19.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

2.19.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.19.8 Reduced-Voltage Controllers

Provide for polyphase motors where indicated. Reduced-voltage starters shall be single-step, closed transition autotransformer or solid state-type, or as indicated, and shall have adjustable time interval between application of reduced and full voltages to motors.

2.20 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Designed for surface mounting with overload protection and pilot lights.

2.20.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color shall be in accordance with NEMA ICS 2. Jewels for use with switches controlling motors shall be green; jewels for other purposes shall be white.

2.21 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 23, "Mechanical."

2.22 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires, cable trays, and other accessories for telecommunications outlets and pathway in accordance with TIA-569 and as specified herein. Additional telecommunications requirements are specified in Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.23 COMMUNITY ANTENNA TELEVISION (CATV) SYSTEM

CATV Outlets

Provide flush mounted, 75-ohm, F-type connector outlet rated from 5 to 1000 MHz in standard electrical outlet boxes with mounting frame.

2.23.2 CATV Faceplates

Provide modular faceplates for mounting of CATV Outlets. Faceplate color shall match outlet and switch coverplates.

2.23.3 Backboards

Provide void-free, fire rated interior grade plywood, 3/4 inch thick, 4 by 8 feet. Do not cover the fire stamp on the backboard.

2.24 GROUNDING AND BONDING EQUIPMENT

2.24.1 Ground Rods

UL 467. Ground rods shall be sectional type, copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.24.2 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated.

2.24.3 Telecommunications and CATV Grounding Busbar

Provide corrosion-resistant grounding busbar suitable for indoor installation in accordance with TIA J-STD-607. Busbars shall be plated for reduced contact resistance. If not plated, the busbar shall be cleaned prior to fastening the conductors to the busbar, and an anti-oxidant shall be applied to the contact area to control corrosion and reduce contact resistance. Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility and a (TGB) in all other telecommunications rooms and equipment rooms. The telecommunications main grounding busbar (TMGB) and the telecommunications grounding busbar (TGB) shall be sized in accordance with the immediate application requirements and with consideration of future growth. Provide telecommunications grounding busbars with the following:

a. Predrilled copper busbar provided with holes for use with standard sized lugs;

b. Minimum dimensions of 0.25 in thick by and <MET>50 mm</MET>2 in wide for TGBs with minimum length;

c. Listed by a nationally recognized testing laboratory.

2.25 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.26 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when

applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.27 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.28 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00, FIRESTOPPING.

2.29 WIREWAYS

UL 870. Material shall be steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with hinged-cover NEMA 1 enclosure per NEMA ICS 6.

2.30 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices which comply with UL 1449 at the service entrance, switchboard, and at panelboards where noted. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
Each phase to neutral (L-N)
Neutral to ground (N-G)
Phase to ground (L-G)

Surge protective devices shall have a minimum surge current rating of 80,000 amperes per mode minimum and 160,000 amperes per phase minimum.

The minimum MCOV (Maximum Continuous Operating Voltage) rating shall be:

300/150V for 120/240V, single phase system
300/150V for 208Y/120V, three phase system
600/320V for 480Y/277V, three phase system

EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

The UL 1449 3rd Edition Voltage Protection Ratings "VPR" (6kV, 3000 Amps, 8/20 microseconds waveform) shall not exceed the system voltage ratings as follows:

208/120V and 240/120V
Line to Neutral, 900V
Line to Ground, 900V
Neutral to Ground, 900V
Line to Line, 1200V

480/277V System
Line to Neutral, 1200V
Line to Ground, 1200V
Neutral to Ground, 1200V
Line to Line, 2000V

The SPD shall have a minimum UL 1449 3rd Edition Nominal Discharge Current Rating (In) of 10,000 Amps.

Surge protective devices shall be compatible with a lightning protection system and meet the requirements of UL 96A.

2.31 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray, and equipment located outdoors shall be ANSI Light Gray or Dark Gray. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or

specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be firestopped in accordance with Section 07 84 00, FIRESTOPPING.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.3.2 Metal Clad Cable

Install in accordance with NFPA 70, Type MC cable.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits in crawl space under floor as if exposed.

3.1.4.1 Restrictions Applicable to EMT

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.

d. Do not use in hazardous areas.

e. Do not use outdoors.

f. Do not use in fire pump rooms.

g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40 and PVC Schedule 80

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms,

electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in fire pump rooms.

(4) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

(5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

(6) Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.3 Restrictions Applicable to MC Cabling

MC Cable may only be used where approved in advance by the Contract Officer and the Project Engineer.

3.1.4.4 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.5 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 18 inches below slab or grade.

3.1.4.6 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40. Convert nonmetallic conduit to plastic-coated rigid, or IMC steel conduit before rising through floor slab. Plastic coating shall extend minimum 6 inches above floor.

3.1.4.7 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.4.8 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

3.1.4.9 Conduit Installed in Concrete Floor Slabs

Rigid steel; steel IMC; or PVC, Type EPC-40. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Increase slab

thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings shall allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab. Where nonmetallic conduit is used, raceway shall be converted to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

3.1.4.10 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.11 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.12 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.13 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.14 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.4.15 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with TIA-569.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room shall be installed and cabling length requirements in accordance with TIA-568-C.1. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling) shall be installed in accordance with TIA-569. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated. 3.1.4.16 Community Antenna Television (CATV) System Conduits

Install a system of CATV wire-supporting structures (pathway), including: outlet boxes, conduits wireways, cable trays, and other accessories for CATV outlets and pathway in accordance with TIA-569. Distribution system shall be star topology from each outlet box to the telecommunications room.

3.1.5 Cable Tray Installation

Install and ground in accordance with NFPA 70. In addition, install and ground telecommunications cable tray in accordance with TIA-569, and TIA J-STD-607. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Support in accordance with manufacturer recommendations but at not more than 10 foot intervals. Contact surfaces of aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. For grounding of cable tray system provide No. 2 AWG bare copper wire throughout cable tray system, and bond to each section, except use No. 1/0 aluminum wire if cable tray is aluminum. Terminate cable trays 10 inches from both sides of smoke and fire partitions. Conductors run through smoke and fire partitions shall be installed in 4 inch rigid steel conduits with grounding bushings, extending 12 inches beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. Penetrations shall be firestopped in accordance with Section 07 84 00, FIRESTOPPING.

Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.6 Telecommunications Cable Support Installation

Install open top and closed ring cable supports on 4 ft to 5 ft centers to adequately support and distribute the cable's weight. These types of supports shall be used to support a maximum of 50 0.25 in diameter cables. Install suspended cables with at least 3 in of clear vertical space above the ceiling tiles and support channels (T-bars). Open top and closed ring cable supports shall be suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.

3.1.7 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, and when specifically indicated. Boxes in other locations shall be sheet steel, except that nonmetallic boxes may be used with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces.Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.7.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets shall be a minimum of 4 11/16 inches square by 2 1/4 inches deep. Mount outlet boxes flush in finished walls.

3.1.7.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, and compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.7.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.

3.1.8 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches and handicapped telecommunications stations 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet.

3.1.9 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.9.1 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.10 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.11 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.12 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.13 Grounding and Bonding

Provide In accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This shall include lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Interconnection to the gas line shall be made on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA J-STD-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.13.1 Ground Rods

Provide cone pointed ground rods. The resistance to ground shall be measured using the fall-of-potential method described in IEEE 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 10 feet on centers, shall be driven with the first rod. Until the resultant resistance does not exceed 25 ohms measured not less than 48 hours after rainfall.

3.1.13.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.13.3 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated. Transformer neutrals and electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to the entrance ground. Connections and splices shall be of the bolted type.

3.1.13.4 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.13.5 Telecommunications System

Provide telecommunications grounding in accordance with the following:

a. Telecommunications Grounding Busbars: Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility.Provide a telecommunications grounding busbar (TGB) in all other telecommunications rooms and telecommunications equipment rooms. The TGB shall be as close to the telecommunications room panelboard as practicable, when equipped. Where a panelboard for telecommunications equipment is not installed in the telecommunications room, the TGB shall be located near the backbone cabling and associated terminations. In addition, the TGB shall be placed to provide for the shortest and straightest routing of the grounding conductors. Where a panelboard for telecommunications equipment is located within the same room or space as a TGB, that panelboard’s alternating current equipment ground (ACEG) bus (when equipped) or the panelboard enclosure shall be bonded to the TGB. Telecommunications grounding busbars shall be installed to maintain clearances as required by NFPA 70 and shall be insulated from its support. A minimum of 2 inches separation from the wall is recommended to allow access to the rear of the busbar and the mounting height shall be adjusted to accommodate overhead or underfloor cable routing.

b. Telecommunications Bonding Conductors: Provide main telecommunications service equipment ground consisting of separate bonding conductor for telecommunications, between the TMGB and readily accessible grounding connection of the electrical service. Grounding and bonding conductors

should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum. Provide a telecommunications bonding backbone (TBB) that originates at the TMGB extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. The TBB conductors shall be installed and protected from physical and mechanical damage. The TBB conductors should be installed without splices and routed in the shortest possible straight-line path. The bonding conductor between a TBB and a TGB shall be continuous. Where splices are necessary, the number of splices should be a minimum and they shall be accessible and located in telecommunications spaces. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors, or equivalent. All joints shall be adequately supported and protected from damage. The TBB and GE shall not be connected to the pathway ground, except at the TMGB or the TGB.

c. Telecommunications Grounding Connections: Telecommunications grounding connections to the TMGB or TGB shall utilize listed compression two-hole lugs, exothermic welding, suitable and equivalent one hole non-twisting lugs, or other irreversible compression type connections. All metallic pathways, cabinets, and racks for telecommunications cabling and interconnecting hardware located within the same room or space as the TMGB or TGB shall be bonded to the TMGB or TGB respectively. In a metal frame (structural steel) building, where the steel framework is readily accessible within the room; each TMGB and TGB shall be bonded to the vertical steel metal frame using a minimum No. 6 AWG conductor. Where the metal frame is external to the room and readily accessible, the metal frame shall be bonded to the TGB or TMGB with a minimum No. 6 AWG conductor. When practicable because of shorter distances and, where horizontal steel members are permanently electrically bonded to vertical column members, the TGB may be bonded to these horizontal members in lieu of the vertical column members. All connectors used for bonding to the metal frame of a building shall be listed for the intended purpose.

3.1.14 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.1.15 Not used

3.1.16 Government-Furnished Equipment

Contractor shall rough-in for Government-furnished equipment and shall make connections to Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

3.1.17 Demolition of Existing Work

Demolition of existing electrical distribution systems shall be performed as follows:

3.1.17.1 Existing Concealed Wiring to be Removed

Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.17.2 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment shall include equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, as indicated.

3.1.18 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 26 23 00

SWITCHBOARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM D1535	(2008e1) Specifying Color by the Munsell System
ASTM D709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012) National Electrical Safety Code
IEEE C37.90.1	(2002; Errata 2003; Errata 2004) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C57.12.28	(2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity

IEEE C57.13	(2008) Standard Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.1	(2008) Electric Meters Code for Electricity Metering
ANSI/NEMA PB 2.1	(2007) General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA LI 1	(1998) Industrial Laminating Thermosetting Products
NEMA PB 2	(2006) Deadfront Distribution Switchboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 489	(2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 891	(2005) Switchboards

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchboard Drawings;

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control

panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

SD-03 Product Data

Switchboard;

SD-06 Test Reports

Acceptance checks and tests;

SD-10 Operation and Maintenance Data

Switchboard Operation and Maintenance, Data Package 5;

SD-11 Closeout Submittals

Assembled Operation and Maintenance Manuals;

Equipment Test Schedule;

Request for Settings;

1.4 QUALITY ASSURANCE

1.4.1 Switchboard Product Data

Each submittal shall include manufacturer's information for each component, device and accessory provided with the switchboard including:

a. Circuit breaker type, interrupting rating, and trip devices, including available settings

b. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device.

1.4.2 Switchboard Drawings

Drawings shall include, but are not limited to the following:

a. One-line diagram including breakers, fuses, current transformers, and meters

b. Outline drawings including front elevation, section views, footprint, and overall dimensions

c. Bus configuration including dimensions and ampere ratings of bus bars

d. Markings and NEMA nameplate data, including fuse information (manufacturer's name, catalog number, and ratings)

e. Circuit breaker type, interrupting rating, and trip devices, including available settings

f. Three-line diagrams and elementary diagrams and wiring diagrams with terminals identified, and indicating prewired interconnections between items of equipment and the interconnection between the items.

g. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device. These shall be used by the designer of record to provide breaker settings that will ensure protection and coordination are achieved.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 MAINTENANCE

1.5.1 Switchboard Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with DIVISION 01 GENERAL REQUIREMENTS.

1.5.2 Assembled Operation and Maintenance Manuals

Manuals shall be assembled and bound securely in durable, hard covered, water resistant binders. The manuals shall be assembled and indexed in the following order with a table of contents. The contents of the assembled operation and maintenance manuals shall be as follows:

a. Manufacturer's O&M information required by the paragraph entitled "SD-10, Operation and Maintenance Data".

b. Catalog data required by the paragraph entitled, "SD-03, Product Data".

c. Drawings required by the paragraph entitled, "SD-02, Shop Drawings".

d. Spare parts and supply list.

e. Information on metering

f. Design test reports

g. Production test reports

1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be switchboards or related accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.2 SWITCHBOARD

NEMA PB 2 and UL 891.

2.2.1 Ratings

The voltage rating of the switchboard shall be 480Y/277 volts AC, 4-wire 3 phase. The continuous current rating of the main bus shall be as indicated. The short-circuit current rating shall be as indicated. The switchboard shall be UL listed and labeled as service entrance equipment.

2.2.2 Construction

Switchboard shall consist of vertical sections bolted together to form a rigid assembly and shall be front aligned. All circuit breakers shall be front accessible. Where indicated, "space for future" or "space" shall mean to include bus, device supports, and connections. Provide insulating barriers in accordance with NEMA LI 1, Type GPO-3, 0.25 inch minimum

thickness. Apply moisture resistant coating to all rough-cut edges of barriers. Switchboard shall be completely factory engineered and assembled, including protective devices and equipment indicated with necessary interconnections, instrumentation, and control wiring.

2.2.2.1 Enclosure

The switchboard enclosure shall be a NEMA ICS 6 Type 1. Enclosure shall be bolted together with removable bolt-on side and rear covers. Bases, frames and channels of enclosure shall be corrosion resistant and shall be fabricated of or galvanized steel. Base shall include any part of enclosure that is within 3 inches of concrete pad. Galvanized steel shall be ASTM A123/A123M, ASTM A653/A653M G90 coating, and ASTM A153/A153M, as applicable. Galvanize after fabrication where practicable. Paint enclosure, including bases, ASTM D1535 light gray No. 61 or No. 49. Paint coating system shall comply with IEEE C57.12.28 for galvanized steel.

2.2.2.2 Bus Bars

Bus bars shall be copper with silver-plated contact surfaces or aluminum with tin-plated contact surfaces. Plating shall be a minimum of 0.0002 inch thick. Make bus connections and joints with hardened steel bolts. The through-bus shall be rated at the full ampacity of the main throughout the switchboard. Provide minimum one-quarter by 2 inch copper ground bus secured to each vertical section along the entire length of the switchboard. The neutral bus shall be rated 100 percent of the main bus continuous current rating.

2.2.2.3 Main Section

The main section shall consist of an individually mounted molded-case, electronic circuit breaker.

2.2.2.4 Distribution Sections

The distribution section shall consist of molded-case circuit breakers as indicated.

2.2.2.5 Handles

Handles for individually mounted devices shall be of the same design and method of external operation. Label handles prominently to indicate device ampere rating, color coded for device type. Identify ON-OFF indication by handle position and by prominent marking.

2.2.3 Protective Device

Provide main and branch protective devices as indicated.

2.2.3.1 Molded-Case Circuit Breaker

UL 489. UL listed and labeled, 100 percent rated, stationary, manually operated, low voltage molded-case circuit breaker, with a short-circuit current rating of as indicated. Breaker frame size shall be as indicated. Series rated circuit breakers are unacceptable.

2.2.4 Electronic Trip Units

Equip main and distribution breakers as indicated with a solid-state tripping system consisting of three current sensors and a microprocessor-based trip unit that will provide true rms sensing adjustable time-current circuit protection. The ampere rating of the current sensors shall be as indicated. The trip unit ampere rating shall be as indicated. Ground fault protection shall be zero sequence sensing. The electronic trip units shall have the features as indicated.

2.2.5 Watthour and Digital Meters

2.2.5.1 Digital Meters

IEEE C37.90.1 for surge withstand. Provide true rms, plus/minus one percent accuracy, programmable, microprocessor-based meter enclosed in sealed cases with a simultaneous three line, twelve value LED display. Meters shall have 0.56 inch, minimum, LEDs. The meters shall accept input from standard 5A secondary instrument transformers and direct voltage monitoring range to 600 volts, phase to phase. Programming shall be via a front panel display and a communication interface with a computer. Password secured programming shall be stored in non-volatile EEPROM memory. Digital communications shall be Modbus RTU protocol via a RS485 serial port. The meter shall calculate and store average max/min demand values for all readings based on a user selectable sliding window averaging period. The meter shall have programmable hi/low set limits with two Form C dry contact relays when exceeding alarm conditions. Meter shall provide Total Harmonic Distortion (THD) measurement to the thirty-first order. Historical trend logging capability shall include ability to store up to 100,000 data points with intervals of 1 second to 180 minutes. The unit shall also store and time stamp up to 100 programmable triggered conditions. Event waveform recording shall be triggered by the rms of 2 cycles of voltage or current exceeding programmable set points.Waveforms shall be stored for all 6 channels of voltage and current for a minimum of 10 cycles prior to the event and 50 cycles past the event.

a. Multi-Function Meter: Meter shall simultaneously display a selected phase to neutral voltage, phase to phase voltage, percent phase to neutral voltage THD, percent phase to phase voltage THD; a selected phase current, neutral current, percent phase current THD, percent neutral current; selected total PF, kW, KVA, kVAR, FREQ, kVAh, kWh. Detected alarm conditions include over/under current, over/under voltage, over/under KVA, over/under frequency, over/under selected PF/kVAR, voltage phase reversal, voltage imbalance, reverse power, over percent THD. The meter shall have a Form C KYZ pulse output relay.

2.2.6 Current Transformers

CT Ratio	RF	Accuracy Class
200/5	4.0	0.3 thru B-0.1
300/5	3.0	0.3 thru B-0.2
400/5	4.0	0.3 thru B-0.2

600/5	4.0	0.3 thru B-0.5
800/5	2.0	0.3 thru B-0.5
1200/5	1.5	0.3 thru B-0.5
1500/5	1.5	0.3 thru B-0.9
2000/5	1.5	0.3 thru B-1.8

IEEE C57.13. Transformers shall be single ratio, 60 hertz, 2000 to 5-ampere ratio, 1.5 rating factor, with a metering accuracy class of 0.3 through B-1.8.

2.2.7 Meter Fusing

Provide a fuse block mounted in the metering compartment containing one fuse per phase to protect the voltage input to voltage sensing meters. Size fuses as recommended by the meter manufacturer.

2.2.8 Terminal Boards

Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Terminal boards associated with current transformers shall be short-circuiting type. Terminate conductors for current transformers with ring-tongue lugs. Terminal board identification shall be identical in similar units. External wiring shall be color coded consistently for similar terminal boards.

2.2.9 Wire Marking

Mark control and metering conductors at each end. Provide factory-installed, white, plastic tubing, heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide white, preprinted, polyvinyl chloride (PVC) sleeves, heat stamped with black block type letters. Each sleeve shall contain a single letter or number, shall be elliptically shaped to securely grip the wire, and shall be keyed in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Each wire marker shall indicate the device or equipment, including specific terminal number to which the remote end of the wire is attached.

2.2.10 Surge Protective Device

Provide as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

2.4 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each switchboard, equipment enclosure, relay, switch, and device; as specified in this section or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.5 SOURCE QUALITY CONTROL

2.5.1 Equipment Test Schedule

The Government reserves the right to witness tests. Provide equipment test schedules for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.

3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.

4. Dated calibration labels shall be visible on all test equipment.

5. Calibrating standard shall be of higher accuracy than that of the instrument tested.

6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.5.2 Switchboard Design Tests

NEMA PB 2 and UL 891.

2.5.2.1 Design Tests

Furnish documentation showing the results of design tests on a product of the same series and rating as that provided by this specification.

a. Short-circuit current test

b. Enclosure tests

c. Dielectric test

2.5.3 Switchboard Production Tests

NEMA PB 2 and UL 891. Furnish reports which include results of production tests performed on the actual equipment for this project. These tests include:

a. 60-hertz dielectric tests

b. Mechanical operation tests

c. Electrical operation and control wiring tests

d. Ground fault sensing equipment test

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Equipment Grounding

Provide bare copper cable not smaller than No. 4/0 AWG not less than 24 inches below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 Switchboard

ANSI/NEMA PB 2.1.

3.3.2 Meters and Instrument Transformers

ANSI C12.1.

3.3.3 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3.4 Galvanizing Repair

Repair damage to galvanized coatings using ASTM A780/A780M, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

3.3.5 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

3.4.1 Interior Location

Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 4 inches thick. The top of the concrete slab shall be approximately 4 inches above finished floor. Edges above floor shall have 1/2 inch chamfer. The slab shall be of adequate size to project at least 8 inches beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 inches above slab surface.

3.5 FIELD QUALITY CONTROL

Contractor shall submit request for settings of breakers to the COR after approval of switchboard and at least 30 days in advance of their requirement.

3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.5.1.1 Switchboard Assemblies

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical, electrical, and mechanical condition.

3. Confirm correct application of manufacturer's recommended lubricants.

4. Verify appropriate anchorage, required area clearances, and correct alignment.

5. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

6. Verify that circuit breaker sizes and types correspond to approved shop drawings.

7. Verify that current transformer ratios correspond to approved shop drawings.

8. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

9. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

10. Clean switchboard.

11. Inspect insulators for evidence of physical damage or contaminated surfaces.

12. Exercise all active components.

13. Inspect all mechanical indicating devices for correct operation.

14. Verify that vents are clear.

15. Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

16. Inspect control power transformers.

b. Electrical Tests

1. Perform insulation-resistance tests on each bus section.

2. Perform overpotential tests.

3. Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.

4. Perform control wiring performance test.

5. Perform primary current injection tests on the entire current circuit in each section of assembly.

3.5.1.2 Circuit Breakers

Low Voltage Molded Case with Solid State Trips

a. Visual and Mechanical Inspection

1. Compare nameplate data with specifications and approved shop drawings.

2. Inspect circuit breaker for correct mounting.

3. Operate circuit breaker to ensure smooth operation.

4. Inspect case for cracks or other defects.

5. Inspect all bolted electrical connections for high resistance using low resistance ohmmeter, verifying tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method, or performing thermographic survey.

6. Inspect mechanism contacts and arc chutes in unsealed units.

b. Electrical Tests

1. Perform contact-resistance tests.

2. Perform insulation-resistance tests.

3. Perform Breaker adjustments for final settings in accordance with Government provided settings.

4. Perform long-time delay time-current characteristic tests

5. Determine short-time pickup and delay by primary current injection.

6. Determine ground-fault pickup and time delay by primary current injection.

7. Determine instantaneous pickup current by primary injection.

8. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and anti-pump function.

3.5.1.3 Current Transformers

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify correct connection.

4. Verify that adequate clearances exist between primary and secondary circuit.

5. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

6. Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

2. Perform insulation-resistance tests.

3. Perform polarity tests.

4. Perform ratio-verification tests.

3.5.1.4 Metering and Instrumentation

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify tightness of electrical connections.

b. Electrical Tests

1. Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

2. Calibrate watthour meters according to manufacturer's published data.

3. Verify all instrument multipliers.

4. Electrically confirm that current transformer and voltage transformer secondary circuits are intact.

3.5.1.5 Grounding System

a. Visual and Mechanical Inspection

1. Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

1. IEEE 81. Perform ground-impedance measurements utilizing the fall-of-potential method.On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.5.2 Follow-Up Verification

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device. Test shall require each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times for checks, settings, and tests.

-- End of Section --

SECTION 26 41 01.00 10

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C135.30	(1988) Standard for Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code
NFPA 780	(2011) Standard for the Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 96	(2005; Reprint Oct 2010) Standard for Lightning Protection Components
UL 96A	(2007; Reprint Oct 2010) Standard for Installation Requirements for Lightning Protection Systems
UL Electrical Construction	(2009) Electrical Construction Equipment Directory

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-07 Certificates

Materials

1.3 QUALITY ASSURANCE

Submit detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide a system consisting of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and which is the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

2.2 MATERIALS

Submit proof of compliance with requirements of UL, where material or equipment is specified to comply. The label of or listing in UL Electrical Construction will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted.

2.2.1 General Requirements

Do not use any combination of materials that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture, unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist, which would cause corrosion of conductors, use conductors with protective coatings or oversize conductors. Where a mechanical hazard is involved, increase the conductor size to compensate for the hazard or protect the conductors by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.2.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.2.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 375 pounds/thousand feet, and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.2.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal.

Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. When perforated strips are provided, strips that are much wider than solid strips shall be. A strip width that is at least twice that of the diameter of the perforations shall be used. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 1-1/2 inch wide.

2.2.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of 2 feet above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 5 feet above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of 15 feet above vent opening. Air terminals more than 24 inch in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

2.2.4 Ground Rods

Rods made of copper-clad steel, stainless steel or solid copper shall conform to UL 467 and galvanized ferrous rods shall conform to IEEE C135.30. Ground rods shall be not less than 3/4 inch in diameter and 10 feet in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.2.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation.

2.2.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INTEGRAL SYSTEM

3.2.1 General Requirements

Provide a lightning protection system consisting of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on

the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.2.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inch for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 24 inch away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 24 inches away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

3.2.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inch. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 3 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.2.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 110 feet long, there shall be at least one additional down conductor for each additional 50 feet of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 250 feet in perimeter, there shall be at least one additional down conductor for each 100 feet of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. On structures exceeding 50 feet in height, there shall be at least one additional down conductor for each additional 60 feet of height or fraction thereof, except that this application shall not cause down conductors to be placed about the perimeter of the structure at intervals of less than 50 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 16 feet in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected by placing in pvc conduit.

3.2.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.2.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.2.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 3 feet, nor more than 8 feet, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value, the Contracting Officer shall be notified immediately. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 3 feet nor more than 8 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous.

3.2.2 Metal Roofs

Wood-Frame, Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 100 feet. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof. Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 3 square inch.

3.2.3 Metal Roofs With Metal Walls

Wood-Frame Building With Metal Roof and Metal Exterior Walls: The metal roof and the metal walls shall be bonded and made electrically continuous and considered as one unit. The air terminals shall be connected to and made electrically continuous with the metal roof as well as the roof and down conductors. All connections shall have electrical continuity and have a surface contact of at least 3 square inch.

3.2.4 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge.Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point of entrance by a ground connector. Connections to pipes shall be by means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding.All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground

connections to grounding electrons or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than 60 feet.

3.3 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. Metal bodies of conductance having an area of 400 square inch or greater or a volume of 1000 cubic inch or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inch. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

3.4 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI ANSLG C78.81	(2010) American National Standard for Electric Lamps--Double-Capped Fluorescent Lamps--Dimensional and Electrical Characteristics

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2007) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

CALIFORNIA ENERGY COMMISSION (CEC)

CEC Title 24	(1978; R 2005) California's Energy Efficiency Standards for Residential and Nonresidential Buildings

GREEN SEAL (GS)

GC-12	(1997) Occupancy Sensors

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000; Errata 2004; Errata 2005; Errata 2006) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012) National Electrical Safety Code
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C78.901	(2005) American National Standard for Electric Lamps - Single Base Fluorescent Lamps--Dimensional and Electrical Characteristics
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C82.11	(2011) American National Standard for High-Frequency Fluorescent Lamp Ballasts--Supplements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA LL 1	(1997; R 2002) Procedures for Linear Fluorescent Lamp Sample Preparation and the TCLP Extraction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2012) Life Safety Code
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1598	(2008; Reprint Jan 2010) Luminaires
UL 773	(1995; Reprint Mar 2002) Standard for Plug-In, Locking Type Photocontrols for Use with Area Lighting

UL 773A	(2006; Reprint Mar 2011) Standard for Nonindustrial Photoelectric Switches for Lighting Control
UL 924	(2006; Reprint Feb 2011) Standard for Emergency Lighting and Power Equipment
UL 935	(2001; Reprint Jun 2010) Standard for Fluorescent-Lamp Ballasts

1.2 RELATED REQUIREMENTS

Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

c. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SYSTEM DESCRIPTION

1.4.1 Lighting Control System

Provide lighting control system as indicated. Lighting control equipment shall include, if indicated: control modules, power packs, dimming ballasts, occupancy sensors, and light level sensors.

1.5 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IESNA HB-9, as applicable, for the lighting system specified.

SD-03 Product Data

Fluorescent lighting fixtures;

Fluorescent electronic ballasts;

Fluorescent lamps;

LED Fixtures;

Incandescent lighting fixtures;

Incandescent lamps;

Lighting contactor;

Photocell switch;

Exit signs;

Emergency lighting equipment;

Occupancy sensors;

SD-06 Test Reports

Operating test

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5

Submit operation and maintenance data in accordance with DIVISION 01 GENERAL REQUIREMENTS and as specified herein, showing all light fixtures, control modules, control zones, occupancy sensors, power packs, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

1.6 QUALITY ASSURANCE

1.6.1 Fluorescent Electronic Ballasts

Submit ballast catalog data as required in the paragraph entitled "Fluorescent Lamp Electronic Ballasts" contained herein. As an option, submit the fluorescent fixture manufacturer's electronic ballast specification information in lieu of the actual ballast manufacturer's catalog data. This information shall include published specifications and sketches, which covers the information required by the paragraph entitled "Fluorescent Lamp Electronic Ballasts" herein. This information may be supplemented by catalog data if required, and shall contain a list of vendors with vendor part numbers.

1.6.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall

include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer

1.6.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.3.3 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 Electronic Ballast Warranty

Furnish the electronic ballast manufacturer's warranty. The warranty period shall not be less than 5 years from the date of manufacture of the electronic ballast. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed 12 months, thereby permitting 4 years of the ballast 5 year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

1.8 OPERATIONAL SERVICE

Indicate procedures for compliance with regulations governing disposal of mercury.

1.9 SUSTAINABLE DESIGN REQUIREMENTS

1.9.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES

UL 1598. Fluorescent fixtures shall have electronic ballasts.

2.1.1 Fluorescent Lamp Electronic Ballasts

The electronic ballast shall as a minimum meet the following characteristics:

a. Ballast shall comply with UL 935, NEMA ANSLG C82.11, NFPA 70, and CEC Title 24 unless specified otherwise. Ballast shall be 100 percent electronic high frequency type with no magnetic core and coil components. Ballast shall provide transient immunity as recommended by IEEE C62.41.1 and IEEE C62.41.2. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.

b. Ballast shall operate at a frequency of 20,000 Hertz (minimum). Ballast shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems. Provide ballasts operating at or above 40,000 Hertz where available.

c. Ballast shall have light regulation of plus or minus 10 percent lumen output with a plus or minus 10 percent input voltage regulation. Ballast shall have 10 percent flicker (maximum) using any compatible lamp.

d. Ballast factor shall be between 0.85 (minimum) and 1.00 (maximum). Current crest factor shall be 1.7 (maximum).

e. Ballast shall be UL listed Class P with a sound rating of "A."

f. Ballast shall have circuit diagrams and lamp connections displayed on the ballast.

g. Ballasts shall be instant start unless otherwise indicated. Instant start ballasts shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed.

h. Ballasts for compact fluorescent fixtures shall be programmed start.

i. Ballasts for T-5 and smaller lamps shall have end-of-life protection circuits as required by ANSI ANSLG C78.81 and ANSI C78.901 as applicable.

j. Ballast shall be capable of starting and maintaining operation at a minimum of 0 degrees F unless otherwise indicated.

k. Electronic ballast shall have a full replacement warranty of 5 years from date of manufacture as specified in paragraph entitled "Electronic Ballast Warranty" herein.

2.1.1.1 T-8 Lamp Ballast

a. Total harmonic distortion (THD): Shall be 20 percent (maximum).

b. Input wattage.

1. 28 watts (maximum) when operating one F28T8 lamp

2.1.2 Fluorescent Lamps

a. T-8 rapid start low mercury lamps shall be rated 28 watts (maximum), 2800 initial lumens (minimum), CRI of 80 (minimum), color temperature of 4100 K, and an average rated life of 20,000 hours. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.

b. Compact fluorescent lamps shall be: CRI 80, minimum, 4100K, 10,000 hours average rated life, and as follows:

1. T-4, triple twin tube, rated 18 watts, 1200 initial lumens (minimum), and 26 watts, 1800 initial lumens (minimum), 32 watts, 2400 initial lumens (minimum).

Average rated life is based on 3 hours operating per start.

2.1.3 Compact Fluorescent Fixtures

Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall use lamps as indicated, with a minimum CRI of 80.

2.1.4 Open-Tube Fluorescent Fixtures

Provide with self-locking sockets, or lamp retainers (two per lamp).

2.2 INCANDESCENT LIGHTING FIXTURES

UL 1598.

2.2.1 Incandescent Lamps

Provide the number, type, and wattage indicated.

2.3 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

2.4 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb

installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

2.5 SWITCHES

2.5.1 Toggle Switches

Provide toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.6 LIGHTING CONTACTOR

NEMA ICS 2, electrically held contactor. Rate contactor as indicated. Provide in NEMA 1 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts. Provide contactor with hand-off-automatic selector switch.

2.7 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 120 volts ac, 60 Hz with single-throw contacts. Switch shall turn on at or below 3 footcandles and off at 2 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide switch:

a. In a cast weatherproof aluminum housing with adjustable window slide, rated 1800 VA, minimum.

2.8 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type. Exit signs shall use no more than 5 watts.

2.8.1 Self-Powered LED Type Exit Signs (Battery Backup)

Provide with automatic power failure device, test switch, pilot light, integral self-testing module and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit sign shall have emergency run time of 1 1/2 hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).

2.9 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

2.9.1 Emergency Lighting Unit

Provide as indicated. Emergency lighting units shall be rated for 12 volts, except units having no remote-mounted lamps and having no more than two

unit-mounted lamps may be rated 6 volts. Equip units with brown-out sensitive circuit to activate battery when ac input falls to 75 percent of normal voltage. Provide integral self-testing module.

2.9.2 Fluorescent Emergency System

Each system shall consist of an automatic power failure device, test switch operable from outside of the fixture, pilot light visible from outside the fixture, and fully automatic solid-state charger in a self-contained power pack. Provide self-testing module integral to the fixture. Charger shall be either trickle, float, constant current or constant potential type, or a combination of these. Battery shall be sealed electrolyte type with capacity as required to supply power to 2 lamps for 90 minutes at the minimum lumens shown on fixture schedule. Battery shall operate unattended and require no maintenance, including no additional water, for a period of not less than 5 years. Emergency ballasts provided with fixtures containing solid-state ballasts shall be fully compatible with the solid-state ballasts.

2.10 SELF-TESTING MODULE

Self-testing module for exit signs and emergency lighting equipment shall perform the following functions:

a. Continuous monitoring of charger operation and battery voltage with visual indication of normal operation and of malfunction.

b. Monthly discharge cycling of battery with monitoring of transfer circuit function, battery capacity and emergency lamp operation with visual indication of malfunction. The battery capacity test may be conducted by using a synthetic load.

c. Manual test switch to simulate a discharge test cycle.

d. Module shall have low voltage battery disconnect (LVD) and brown-out protection circuit.

2.11 OCCUPANCY SENSORS

UL listed. Comply with GC-12. Occupancy sensors and power packs shall be designed to operate on the voltage indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator.Sensor shall have adjustable sensitivity and adjustable delayed-off time range of 5 minutes to 15 minutes. Wall mounted sensors shall match the color of adjacent wall plates as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated.

a. Ultrasonic sensor shall be crystal controlled and shall not cause detection interference between adjacent sensors.

b. Infrared sensors shall have a daylight filter. Sensor shall have a fresnel lens that is applicable to space to be controlled.

c. Ultrasonic/Infrared Combination Sensor

d. Microwave and audiophonic sensors.

Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection. Lights shall remain on if either the ultrasonic or infrared sensor detects movement. Infrared sensor shall have lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Ultrasonic sensor frequency shall be crystal controlled.

2.12 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

2.12.1 Wires

ASTM A641/A641M, galvanized regular coating, soft temper, 0.1055 inches in diameter (12 gage).

2.12.2 Straps

Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.12.3 Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.13 EQUIPMENT IDENTIFICATION

2.13.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.13.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. All luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only_____":

a. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

c. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

d. ANSI ballast type (M98, M57, etc.) for HID luminaires.

e. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

All markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.14 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer.

3.1.2 Lighting Fixtures

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four wires or straps or rods per fixture and located near each corner of each fixture. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires or straps or rods per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture. Provide wires or straps or rods for lighting fixture support in this section. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

3.1.3 Suspended Fixtures

Suspended fixtures shall be provided with 45 degree swivel hangers so that they hang plumb and shall be located with no obstructions within the 45

degree range in all directions. The stem, canopy and fixture shall be capable of 45 degree swing. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degree separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.4 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.

3.1.5 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations. Set adjustable window slide for 3 minimum footcandles photocell turn-on.

3.1.6 Occupancy Sensor

Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage shall provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid nuisance activation and deactivation due to sudden temperature or airflow changes and usage. Set sensor "on" duration to 10 minutes.

3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.

3.3.1 Occupancy Sensor

Test sensors for proper operation. Observe for light control over entire area being covered.

-- End of Section --

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS-4	(2006) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C136.21	(2004) Roadway Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 108	(2006) Standard Specification for Aluminum-Alloy Permanent Mold Castings

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000; Errata 2004; Errata 2005) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; Errata 2007) National Electrical Safety Code
IEEE Std 100	(2000) The Authoritave Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C136.13	(2004) Roadway Lighting Equipment, Metal Brackets for Wood Poles
NEMA C136.3	(2005) Roadway and Area Lighting Equipment Luminaire Attachments
NEMA C78.42	(2004) Standard for High-Pressure Sodium Lamps
NEMA C78.43	(2007) Standard for Electric Lamps - Single-Ended Metal-Halide Lamps
NEMA C82.4	(2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
NEMA ICS 2	(2000; Errata 2002; R 2005; Errata 2006) Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment
NEMA ICS 6	(1993; R 2006) Standard for Industrial Controls and Systems Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1029	(1994; Rev thru Feb 2006) Standard for Safety High-Intensity-Discharge Lamp Ballasts
UL 1598	(2004; Rev thru May 2006) Luminaires
UL 773	(1995; Rev thru Mar 2002) Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2006) Nonindustrial Photoelectric Switches for Lighting Control

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Energy Efficiency

Luminaires;

Lamps;

Ballasts;

Lighting contactor;

Time switch;

Photocell switch;

Aluminum poles;

SD-06 Test Reports

Operating test;

Submit operating test results.

SD-10 Operation and Maintenance Data

Operational Service

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project.

1.4 QUALITY ASSURANCE

1.4.1 Not used.

1.4.2 Not used.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer Technical Representative.

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Aluminum Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

1.6.2 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

1.7 WARRANTY

Comply with warranty provisions of Section 01 78 00, "CLOSEOUT SUBMITTALS." The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render

satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 OPERATIONAL SERVICE

Indicate procedures for compliance with regulations governing disposal of mercury.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in Section 26 51 00 INTERIOR LIGHTING.

2.2 LUMINAIRES

UL 1598. Provide luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.2.1 Lamps

2.2.1.1 High-Pressure Sodium (HPS) Lamps

NEMA C78.42. Wattage as indicated. HPS lamps shall have average rated life of 16,000 hours (minimum) for 35 watt lamps and 24,000 hours (minimum) for all higher wattage lamps. 150 watt lamps, if required, shall be 55 volt lamps. Lamps shall have Luminaire Efficiency Ratings (LER) as follows:

a. Upward efficiency of 0%

    1. 150-399 watts: minimum 58 LER for closed fixture; minimum 68 for open fixture

    2. 400-999 watts: minimum 63 LER for closed fixture; minimum 84 for open fixture

b. Upward efficiency of 1%-10%

    1. 150-399 watts: minimum 64 LER for closed fixture; minimum 63 for open fixture

    2. 400-999 watts: minimum 82 LER for closed fixture; minimum 89 for open fixture

    3. 1000+ watts: minimum 109 LER for open fixture

c. Upward efficiency of 11% to 20%

1. 150-399 watts: minimum 78 LER for open fixture

2. 400-999 watts: minimum 94 for open fixture

d. Upward efficiency greater than 20%

1. 150-399 watts: minimum 75 LER for closed fixture; minimum 77 for open fixture

2.2.1.2 Metal-Halide Lamps

Provide luminaires with tempered glass lens.

a. Single-ended, wattage as indicated, conforming to NEMA C78.43

Lamps shall have Luminaire Efficiency Ratings (LER) as follows:

a. Upward efficiency of 0%

1. 150-399 watts: minimum 41 LER for closed fixture

2. 400-999 watts: minimum 53 LER for closed fixture; minimum 59 for open fixture

3. 1000+ watts: minimum 77 LER for closed fixture

b. Upward efficiency of 1%-10%

1. 150-399 watts: minimum 56 LER for closed fixture

2. 400-999 watts: minimum 62 LER for closed fixture; minimum 64 for open fixture

3. 1000+ watts: minimum 88 LER for open fixture

c. Upward efficiency greater than 20%

1. 150-399 watts: minimum 62 LER for closed fixture; minimum 77 for open fixture

2. 400-999 watts: minimum 65 LER for closed fixture

2.2.2 Ballasts for High-Intensity-Discharge (HID) Luminaires

UL 1029 and NEMA C82.4, and shall be constant wattage autotransformer (CWA) or regulator, high power-factor type (minimum 90%). Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts shall be:

a. Designed to operate on voltage system to which they are connected.

b. Constructed so that open circuit operation will not reduce the average life.

HID ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 degrees C.

2.3 LIGHTING CONTACTOR

NEMA ICS 2, mechanically held contactor. Rate contactor as indicated. Provide in NEMA 4 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts and coil clearing contacts for mechanically held contactor and shall require no arcing contacts. Provide contactor with hand-off-automatic selector switch.

2.4 TIME SWITCH

Astronomic dial type or electronic type, arranged to turn "ON" at sunset, and turn "OFF" at predetermined time between 8:30 p.m. and 2:30 a.m. or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide switch rated 208 volts, having automatically wound spring mechanism or capacitor, to maintain accurate time for a minimum of 7 hours following power failure. Provide time switch with a manual on-off bypass switch. Housing for the time switch shall be surface mounted, NEMA 1 enclosure conforming to NEMA ICS 6.

2.5 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 208 volts ac, 60 Hz with single-throw contacts designed to fail to the ON position. Switch shall turn on at or below 3 footcandles and off at 4 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition. Provide switch:

a. Integral to the luminaire, rated 1000 VA, minimum.

2.6 POLES

Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS-4 while supporting luminaires and all other appurtenances indicated.The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws. Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole. Scratched, stained, chipped, or dented poles shall not be installed.

2.6.1 Aluminum Poles

Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a round or tapered cover. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B 108 and shall be machined to receive the lower end of shaft.Joint between shaft and base shall be

welded. Base cover shall be cast 356-T6 aluminum alloy in accordance with ASTM B 108. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel. Manufacturer's provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

2.7 BRACKETS AND SUPPORTS

NEMA C136.3, NEMA C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

2.8 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A 153/A 153M. Concrete shall be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.9 EQUIPMENT IDENTIFICATION

2.9.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. Luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only_____":

a. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

c. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

d. ANSI ballast type (M98, M57, etc.) for HID luminaires.

e. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.10 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Aluminum Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3.1.2 Pole Setting

Depth shall be as indicated. Poles in straight runs shall be in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6 inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

3.1.3 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.1.4 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.1.5 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

SECTION 27 05 14.00 10

CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 SYSTEM DESCRIPTION

Provide a cable TV premises distribution system consisting of coaxial cables, amplifiers, and connecting hardware for the transport of television signals throughout the building to user locations as indicated.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Test Plan;
Qualifications;

SD-06 Test Reports

Testing

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

1.4 QUALIFICATIONS

Submit proof of the qualifications of the Contractor, Installers, and Manufacturers that will perform the work, and provide the specified products.

1.4.1 Minimum Contractor Qualifications

Work under this section shall be performed, and equipment shall be furnished and installed, by a qualified Contractor as defined herein. The Contractor shall have a minimum of two years of experience in the installation and testing of coaxial cable-based TV distribution systems and equipment. Installers assigned to the installation of this system or its components shall have a minimum of two years of experience in the installation of the specified coaxial cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract shall be products of manufacturers that have a minimum of two years of experience in producing the types of systems and equipment specified.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.6 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that are the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70. Cables shall be labeled on both ends with circuit number, room number, or other appropriate marking allowing for correct identification of the cable and its destination. Each faceplate shall be labeled with its function and a unique number to identify the cable run.

2.1.1 Coaxial Cable

Coaxial cable shall be RG-6/U, quad shield. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals identifying cable type. Cable shall be rated CMP in accordance with NFPA 70. Interconnecting cables shall be cable assemblies consisting of RG-6/U coaxial cable with male connectors at each end, provided in lengths determined by equipment locations as shown.

2.1.2 Outlets

Cable television outlets, including wall outlet plates, shall be equipped with a female connector to accept the connecting coaxial cable from the user's television set. Faceplates provided shall be ivory resistant plastic.

2.1.3 Outlet Boxes

Electrical boxes for cable television outlets shall be 4-11/16 inch square by 2-1/4 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Conduits shall be minimum 1 inch.

PART 3 EXECUTION

3.1 INSTALLATION

Install system components and appurtenances in accordance with NFPA 70, manufacturer's instructions and as shown. Provide necessary interconnections, services, and adjustments required for a complete cable television distribution system, ready to connect to external television signal sources. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07 84 00 FIRESTOPPING. Install conduits, outlets, raceways, and wiring in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Cables and outlets shall be individually labeled and marked. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Cable Installation

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Cable not in a wireway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated unless shown otherwise. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. Provide 20 foot long service loop in telecommunication rooms.

3.1.2 Cables

Cables shall have a minimum of 6 inches of slack cable loosely coiled into the cable television outlet boxes. Minimum manufacturer's bend radius shall not be exceeded.

3.1.3 Pull Cords

Pull cords shall be installed in conduits serving the cable television premises distribution system which do not initially have cable installed.

3.2 TERMINATIONS

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. Coaxial cables shall be terminated with appropriate connectors as required. Cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.3 GROUNDING

The cable television distribution system ground shall be installed in the cable television entrance facility and in any auxiliary closet identified in

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM or otherwise indicated. Equipment racks shall be connected to the electrical safety ground.

3.4 TESTING

Submit test reports in booklet form with witness signatures verifying execution of tests. The cable system testing documentation shall include the physical routing and a test report for each cable (end-to-end) from the installed outlet to the main termination point. Test reports shall be submitted within 14 days after completion of testing. Materials and documentation to be furnished under this specification are subject to inspections and tests.

a. Submit a Test Plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 30 days prior to the proposed test date. The plan shall be approved before testing begins. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

b. Components shall be terminated prior to testing.

c. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the cable television premises distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

d. After installation of the cable and before connecting system components, each cable section shall be end-to-end tested using a time domain reflectometer (TDR) to determine shorts, opens, kinks, and other impedance discontinuities and their locations. Cable sections showing adverse impedance discontinuities (greater than 6 dB loss) shall be replaced at the Contractor's expense.

e. There shall be no cable splices between system components unless approved by the Government.

3.5 OPERATION AND MAINTENANCE MANUALS

SD-10 Submit commercial, off-the-shelf manuals for operation, installation, configuration, and maintenance of products provided as a part of the cable television premises distribution system. Specification sheets for cable, connectors, and other equipment shall be provided as specified in the Submittals paragraph.

-- End of Section --

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-90-661	(2008) Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables for Use in General Purpose and LAN Communications Wiring Systems Technical Requirements

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA/BICSI 568	(2006) Standard for Installing Building Telecommunications Cabling

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66	(2001; Errata 2003) Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA J-STD-607	(2002a) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
TIA-1152	(2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

TIA-568-C.0	(2009; Add 1 2010) Generic Telecommunications Cabling for Customer Premises
TIA-568-C.1	(2009) Commercial Building Telecommunications Cabling Standard
TIA-568-C.2	(2009; Errata 2010) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568-C.3	(2008; Corrections 2008) Optical Fiber Cabling Components Standard
TIA-569	(2004b; Add 1 2009) Commercial Building Standard for Telecommunications Pathways and Spaces
TIA/EIA-606	(2002a; Errata 2007; R 2007; Adm 1 2008) Administration Standard for the Telecommunications Infrastructure

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68	Connection of Terminal Equipment to the Telephone Network (47 CFR 68)

UNDERWRITERS LABORATORIES (UL)

UL 1286	(2008; Reprint Jan 2011) Office Furnishings
UL 1863	(2004; Reprint Aug 2008) Communication Circuit Accessories
UL 444	(2008; Reprint Apr 2010) Communications Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(1995; Reprint Nov 2008) Standard for Marking and Labeling Systems

1.2 RELATED REQUIREMENTS

Technical Criteria for the Installation Information Infrastructure Architecture (I3A) applies to this section.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA/EIA-606 and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

1.3.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.3.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.7 Open Cable

Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed horizontal cabling, horizontal pathways, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a

building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.5 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Telecommunications cabling (horizontal);

Patch panels;

Telecommunications outlet/connector assemblies;

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing;

SD-07 Certificates

Telecommunications Contractor Qualifications;

Test plan;

1.6 QUALITY ASSURANCE

1.6.1 Not used

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation,

and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.2.2 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, 30 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size.The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package 5.

PART 2 PRODUCTS

2.1 COMPONENTS

Comments shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569. Provide system furniture pathways in accordance with UL 1286.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and NFPA 70. Provide a labeling system for cabling as required by TIA/EIA-606 and UL 969. Ship cable on reels or in boxes bearing manufacture date for unshielded twisted pair (UTP) in accordance with ICEA S-90-661 for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.3.1 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568-C.1.

2.3.1.1 Horizontal Copper

Provide horizontal copper cable, UTP, 100 ohm in accordance with TIA-568-C.2, UL 444, ANSI/NEMA WC 66, ICEA S-90-661. Provide four each individually twisted pair, minimum size 24 AWG conductors, Category 6, with a thermoplastic jacket. Provide a blue jacket for voice and a yellow jacket for data. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with ICEA S-90-661. Provide plenum (CMP) communications rated cabling in accordance with NFPA 70. Cables installed in conduit within and under slabs shall be UL listed and labeled for wet locations in accordance with NFPA 70.

2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility and telecommunication equipment room to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with TIA/EIA-606.

2.4.1 Backboards

Provide void-free, interior grade A-C plywood 3/4 inch thick 4 by 8 feet. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible. Backboards shall be provided on a minimum of two adjacent walls in the telecommunication spaces.

2.4.2 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 6 systems. Provide blocks for the number of horizontal cables terminated on the block plus 25 percent spare.

2.4.3 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on equipment racks cabinets and telecommunications backboards.

2.4.4 Patch Panels

Provide ports for the number of horizontal cables terminated on the panel plus 25 percent spare. Provide pre-connectorized copper patch cords for patch panels, one for each connected port. Provide patch cords, as complete assemblies, with matching connectors as specified, 7 feet in length with blue jacket. Patch cords shall meet minimum performance requirements specified in TIA-568-C.1, TIA-568-C.2 for cables, cable length and hardware specified.

2.4.4.1 Modular to 110 Block Patch Panel

Provide in accordance with TIA-568-C.1 and TIA-568-C.2. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Panel shall be constructed of 0.09 inches minimum aluminum and shall be rack mounted and compatible with an existing equipment cabinet. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568B(verify and match existing wiring method). Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68, TIA-568-C.1, and TIA-568-C.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568-C.2 Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired as indicated in subparagraph, Modular to 110 Block Patch Panel. UTP outlet/connectors shall comply with TIA-568-C.2 for 200 mating cycles.Provide pre-connectorized patch cords, one for each port, 12 feet in length with blue jacket.

2.5.2 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568-C.1, TIA-568-C.2; flush design constructed of high impact thermoplastic material ivory in color to match color. Provide labeling in accordance with the paragraph LABELING in this section.

2.6 GROUNDING AND BONDING PRODUCTS

Provide in accordance with UL 467, TIA J-STD-607, and NFPA 70. Components shall be identified as required by TIA/EIA-606. Provide ground rods, bonding conductors, and grounding busbars.

2.7 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.8 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when

applicable, the position. Nameplates shall be melamine plastic, 0.125 inches thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inches high normal block style.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with NECA/BICSI 568, TIA-568-C.1, TIA-568-C.2, TIA-569, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.

3.1.1 Cabling

Install UTP, telecommunications cabling system as detailed in TIA-568-C.1, TIA-568-C.2. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays. Install in accordance with TIA-568-C.1, TIA-568-C.2.Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

Plenum cable shall be used where open cables are routed through plenum areas. Plenum cables shall comply with flammability plenum requirements of NFPA 70.

3.1.1.2 Horizontal Cabling

Install horizontal cabling as indicated on drawings Do not untwist Category 6 UTP cables more than one half inch from the point of termination to

maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, 10 feet in the telecommunications room, and 12 inches in the work area outlet.

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70.

3.1.3 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only CMP type cable shall be installed in a plenum.

3.1.4 Work Area Outlets

3.1.4.1 Terminations

Terminate UTP cable in accordance with TIA-568-C.1, TIA-568-C.2 and wiring configuration as specified.

3.1.4.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.4.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.4.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.5 Telecommunications Space Termination

Install termination hardware required for Category 6 system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

3.1.5.1 Connector Blocks

Connector blocks shall be wall mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with TIA-569.

3.1.5.2 Patch Panels

Patch panels shall be mounted in equipment cabinets provided by FLETC. Provide sufficient ports to accommodate the installed cable plant plus 25 percent spares.

a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel with cable ties to prevent movement of the cable.

3.1.5.3 Equipment Support Frames

Install in accordance with TIA-569:

a. Cabinets, freestanding modular type. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets.

3.1.6 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

3.1.7 Grounding and Bonding

Provide in accordance with TIA J-STD-607, NFPA 70.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA/EIA-606. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process or laser printer.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA/EIA-606.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA/EIA-606.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

If backboards are required to be painted, then the manufactured fire retardant backboard must be painted with fire retardant paint, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be unpainted.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1, TIA-568-C.2. Test equipment shall conform to TIA-1152.

3.5.1.1 Inspection

Visually inspect UTP jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross-connected.

3.5.1.3 Performance Tests

Perform testing for each outlet as follows:

a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

3.5.1.4 Final Verification Tests

Perform verification tests for UTP systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

a. Voice Tests.These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --

SECTION 28 31 64.00 10

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1221	(2010) Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code
NFPA 72	(2010; TIA 10-4) National Fire Alarm and Signaling Code
NFPA 90A	(2009; Errata 09-1) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2006; Reprint Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL 268	(2009) Smoke Detectors for Fire Alarm Systems

UL 268A	(2008; Reprint Sep 2009) Smoke Detectors for Duct Application
UL 38	(2008; Reprint Dec 2008) Manual Signaling Boxes for Fire Alarm Systems
UL 464	(2009; Reprint Jan 2011) Standard for Audible Signal Appliances
UL 521	(1999; Reprint May 2010) Heat Detectors for Fire Protective Signaling Systems
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 864	(2003; Reprint Jan 20110) Standard for Control Units and Accessories for Fire Alarm Systems

1.2 SYSTEM DESCRIPTION

The fire detection and alarm system and the central reporting system shall be a complete, supervised fire alarm reporting system configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. Furnish equipment compatible and UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards. Locks shall be keyed alike. Provide four keys for the system. Furnish tags with stamped identification number for keys and locks.

1.2.1 Operation

Activate the system into the alarm mode by actuation of any alarm initiating device. The system will remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm and supervisory initiating devices shall be individually addressable. Alarm initiating devices shall be connected to initiating device circuits (IDC), Class B, to signal line circuits (SLC), Classe B, in accordance with NFPA 72. Connect alarm notification appliances to notification appliance circuits (NAC), Class A in accordance with NFPA 72. Provide a looped conduit system so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

a. Sufficient memory to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors.

c. Capability of each addressable device being individually disabled or enabled from the panel.

d. Size each SLC to provide 40 percent addressable expansion without hardware modifications to the panel.

1.2.2 Operational Features

The system shall have the following operating features:

a. Monitor electrical supervision of IDC, SLC, and NAC circuits.

b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. Submit Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.

f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD displays on the control panel nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.

g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.

h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.

i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.

k. The fire alarm control panel shall monitor and control the fire sprinkler system, fire pump controllers, or other fire protection extinguishing system.

l. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

n. Fire alarm shall be arranged as indicated on the contract drawings.

1.2.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the functions shown on the design drawings.

1.2.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.2.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.2.6 Interface With Existing Fire Alarm Equipment

The entire existing fire alarm system including all panels shall be demolished after the new system has been accepted.

1.2.7 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc. Components shall also be

compatible with proprietary supervising station receiving equipment (Bosch D6600).

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Storage Batteries
Low Battery Voltage
Special Tools and Spare Parts
Technical Data and Computer Software
Training
Testing

SD-06 Test Reports

Testing

SD-07 Certificates

Equipment
Qualifications

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions;

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Submit proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

1.4.1.1 Engineer and Technician

a. Registered Professional Engineer in the State of Georgia with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.4.1.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.4.1.3 Fire Protection Engineer

The fire protection engineer shall be registered in the State of Georgia.

1.4.2 Detail Drawings

Submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical audible appliances. Check the layout based on the actual audible devices to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detail drawings and detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

a. Identification of programmable portions of system equipment and capabilities.

b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

c. Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.

d. Description of Fire Alarm Control Panel equipment operation.

e. Description of auxiliary and remote equipment operations.

f. Library of application software.

g. Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

1.7 SPECIAL TOOLS AND SPARE PARTS

Submit spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service. Furnish software, connecting cables, proprietary equipment and two spare fuses of each type and size required, necessary for the maintenance, testing, and reprogramming of the equipment. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Mount spare fuses in the fire alarm panel.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

2.2 NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

2.3 FIRE ALARM CONTROL PANEL

The Fire Alarm Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches.

a. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices

(meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system.

b. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other devices. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

c. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units.Cabinets shall be painted red.

2.3.1 Circuit Connections

Connect circuit conductors entering or leaving the panel to screw-type terminals with each conductor and terminal marked for identification.

2.3.2 System Expansion and Modification Capabilities

Provide, as part of this contract, any equipment and software needed by qualified technicians to implement future changes to the fire alarm system.

2.3.3 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Class B notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.3.4 Addressable Initiating Device Circuits Module

Configure the initiating device being monitored as a Class B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time

the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.4 STORAGE BATTERIES

Submit substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included. Provide storage batteries which are 24 Vdc sealed, lead-calcium type requiring no additional water with ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 24 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 5 minutes. Locate batteries at the bottom of the panel. Provide batteries with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Paint the cabinets to match the fire alarm control panel.

2.5 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Locate charger in control panel cabinet or in a separate battery cabinet.

2.6 FIRE ALARM MANUAL STATIONS

Fire alarm manual stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on surface mounted outlet boxes. Manual stations shall be mounted at 48 inches. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations.

2.7 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually

addressable, except where indicated. Installed devices shall conform to NFPA 70 hazard classification of the area where devices are to be installed.

2.7.1 Smoke Detectors

Design smoke detectors for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location. Smoke detector shall be provided above panel in Fire Pump Room.

2.7.1.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.7.1.2 Duct Smoke Detectors

Duct smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.8 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be

painted red. Recessed audible appliances shall be installed with a grill that is painted red.

2.8.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.8.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 15 candela, but shall be sized as shown on drawings. Strobe shall be surface mounted.

2.8.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.9 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.9.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.9.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 16 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

2.10 TRANSMITTERS

2.10.1 Digital Alarm Communicator Transmitters (DACT)

Transmitters shall be compatible with proprietary supervising station receiving equipment (Bosch D6600). Each transmitter shall be the

manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is Bosch D6600 through windows based management Mastermind and the transceiver shall be fully compatible with this equipment. At the Contractors option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel. The DACT shall receive an alarm, supervisory, or trouble signal from the control unit and automatically capture two telephone lines(s) and dial a preset number for a remote central station. When contact is made with the central station, signals shall be transmitted in contact ID protocol. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station.

2.10.1.1 Transmitter Power Supply

Each transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery in addition to manufacturers operation power requirements.

a. Operation: Each transmitter shall operate from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall also be automatic.

b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 24 hours and be capable of transmitting alarms during that period.

2.10.1.2 Digital Alarm Communicator Transmitter Housing

Transmitter housing shall be NEWMAN Type 1. The housing shall contain a lock that is keyed identical to the fire alarm system for the building. Digital alarm communicator transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.11 FIRE ALARM ANNUNCIATOR

2.11.1 FIRE ALARM ANNUNCIATOR PANEL

Provide an annunciator that includes an LCD display. The display shall indicate the device in trouble/alarm or any supervisory device. Display the device name, address, and actual building location. A building floor plan shall be provided mounted (behind plexiglass or similar protective material) at the annunciator location. The floor plan shall indicate all rooms by name and number including the locations of stairs and elevators.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

Install all work as shown, in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.2.1 Power Supply for the System

Provide a single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system panel. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.2.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.2.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. Manually operable controls shall be between 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.2.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be

provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location.

3.2.5 Notification Appliances

Notification appliances shall be mounted 80 inches above the finished floor or 6 inches below the ceiling, whichever is lower.

3.2.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.2.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in Section 21 13 13.00 10 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, as indicated on the drawings and as specified herein.

3.2.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall he mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in Section 21 13 13.00 10 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, as indicated on the drawings and as specified herein.

3.3 OVERVOLTAGE AND SURGE PROTECTION

3.3.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.3.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.3.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.4 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.5 TRAINING

Submit lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. Conduct the course in the building where the system is installed or as designated by the Contracting Officer.

a. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system. Provide training course for the maintenance staff.The training period for system expansions and modifications shall consist of at least 1/2 training day (4 hours) and shall start after the system is functionally completed but prior to final acceptance tests.

3.6 TESTING

Notify the Contracting Officer and the Fire Protection Engineer at least 10 days before the preliminary and acceptance tests are to be conducted. Perform the tests in accordance with the approved test procedures in the

presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. Furnish instruments and personnel required for the tests. The Fire Protection Engineer needs to be present and sign off on all testing conducted for the fire protection systems.

a. Submit detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

b. Submit test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. Include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

3.6.1 Preliminary Tests

Upon completion of the installation, subject the system to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. Conduct the megger test prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing complete and submit the NFPA 72, Certificate of Completion and Testing Form.

3.6.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Conduct testing in accordance with NFPA 72. The recommended tests in NFPA 72 are considered mandatory and shall verify that previous deficiencies have been corrected. The Fire alarm Technician supervising the installation of the fire alarm system shall attend the testing of the system. The test shall include all requirements of NFPA 72 and the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of each alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault each circuit.

k. Short circuit faults each circuit.

l. Stray voltage test.

m. Loop resistance test.

-- End of Section --

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 MEASUREMENT PROCEDURES

1.2 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Material character is indicated by the boring logs.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA P5	(2009) Standard for Waterborne Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM A139/A139M	(2004; R 2010) Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and over)

ASTM A252	(2010) Standard Specification for Welded and Seamless Steel Pipe Piles
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM D1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.4 DEFINITIONS

1.4.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SC, CL, ML, CL-ML. Satisfactory materials for grading comprise stones less than 1.5 inches in any dimension.

1.4.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and

material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.4.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136, ASTM D422, and ASTM D1140.

1.4.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.4.5 Topsoil

Material suitable for topsoils obtained from offsite areas and excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.4.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.4.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.4.8 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.4.9 Select Granular Material

1.4.9.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, or SP by ASTM D2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index must not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D1140.

1.4.10 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 1.5 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 1.5 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.4.11 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 15 when tested in accordance with ASTM D4318.

1.5 SYSTEM DESCRIPTION

Subsurface soil boring logs are appended to the SPECIAL CONTRACT REQUIREMENTS. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.5.1.2 Rock Excavation

Submit notification of encountering rock in the project. Include rock excavation with blasting, excavating, grading, disposing of material classified as rock, and the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove

without systematic drilling and blasting; and hard materials (see Definitions). Include the removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic yard in volume that may be encountered in the work in this classification.If at any time during excavation, the Contractor encounters material that may be classified as rock excavation, uncover such material and notify the Contracting Officer. Do not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.5.2 Blasting

Blasting will not be permitted.

1.5.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.6 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Testing
Borrow Site Testing

SD-07 Certificates

Testing

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1.Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Within 24 hours of conclusion of physical tests, submit 3 copies of test results, including calibration curves and results of calibration tests. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

Provide Bedding material, Filter fabric and rock conforming to these requirements for construction indicated.

2.4.1 Bedding Material

Provide bedding material consisting of sand, gravel, or crushed rock, well graded, with a maximum particle size of 2 inches. Compose material of tough, durable particles. Allow fines passing the No. 200 standard sieve with a plasticity index less than six.

2.4.2 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Provide rock with a minimum specific gravity of 2.50. Do not permit the inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines.

2.5 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Conform to ASTM C33/C33M for fine aggregate grading with a maximum of 3 percent by weight passing ASTM D1140, No. 200 sieve, or 1-1/2 inch and no more than 2 percent by weight passing the No. 4 size sieve or coarse aggregate Size 57, 67, or 77.

2.6 PIPE CASING

2.6.1 Casing Pipe

ASTM A139/A139M, Grade B, or ASTM A252, Grade 2, smooth wall pipe. Match casing size to the outside diameter and wall thickness as indicated on the plans. Protective coating is not required on casing pipe.

2.6.2 Wood Supports

Locally available, rough, structural grade. Provide wood with nonleaching water-borne pressure preservative (ACA or CCA) and treatment conforming to AWPA P5 and AWPA C2, respectively. Secure wood supports to carrier pipe with stainless steel or zinc-coated steel bands.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Remove from the site any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the

limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the plans. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation

and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 2 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete.

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter.Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.5.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

3.3 SHORING

3.3.1 General Requirements

Submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.4 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and wasted materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.5 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.6 GROUND SURFACE PREPARATION

3.6.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.6.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3.7 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Do not waste any satisfactory excavated material without specific

written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.8 BURIED TAPE AND DETECTION WIRE

3.8.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.8.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over it's entire length.Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.9 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9.1 Trench Backfill

Backfill trenches to the grade shown. Do not backfill the trench until all specified tests are performed.

3.9.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.9.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.9.1.3 Bedding and Initial Backfill

Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ASTM D698 maximum density.Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

a. Class I: Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.9.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, with satisfactory material. Place backfill material and compact as follows:

a. Roadways, Railroads, and Airfields: Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.9.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.10 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.10.1 Rip-Rap Construction

Construct rip-rap on filter fabric in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.10.1.1 Bedding Placement

Spread filter fabric bedding material uniformly to a thickness of at least 3 inches on prepared subgrade as indicated.

3.10.1.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.11 SUBGRADE PREPARATION

3.11.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Proof roll the existing subgrade of the parking areas with six passes of a 3-1/2 ton pneumatic-tired roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2-1/2 to 3-1/2 mph. Provide one-half of the passes made with the roller in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material and replace with select material.

3.11.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inches below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.11.3 Compaction

Finish compaction by pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 90 percent of laboratory maximum density.

3.11.3.1 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 6 inches of subgrade.

3.12 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.12.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.12.2 Capillary Water Barrier

Place a capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.12.3 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.13 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 4 inches and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.14 TESTING

Perform testing by a Government validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the

testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Government validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with ASTM D1556.

b. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.14.1 Fill and Backfill Material Gradation

One test per 500 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136.

3.14.2 In-Place Densities

a. One test per 1500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 1500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

3.14.3 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.14.4 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material to determine the optimum moisture and laboratory maximum density values. One representative test per 100 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.14.5 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.14.6 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 36 inches, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras

passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.15 DISPOSITION OF SURPLUS MATERIAL

Provide surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber as removed from Government property as directed by the Contracting Officer.

-- End of Section --

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section 01 57 50, TEMPORARY ENVIRONMENTAL CONTROLS. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer's Technical Representative immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer's Technical Representative in ample time to minimize interruption of the service.

3.2 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.3 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.4 DISPOSAL OF MATERIALS

3.4.1 Nonsaleable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

-- End of Section --

SECTION 31 31 16

SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

7 USC Section 136	Federal Insecticide, Fungicide, and Rodenticide Act

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Termiticide Application Plan; G

Termiticide application plan with proposed sequence of treatment work with dates and times. The termiticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area/volume treated, amount applied; and the name and state license number of the state certified applicator shall be included.

Termiticides; G

Manufacturer's label and Material Safety Data Sheet (MSDS) for termiticides proposed for use.

Foundation Exterior

Written verification that other site work will not disturb the treatment.

Utilities and Vents

Written verification that utilities and vents have been located.

Verification of Measurement

Written verification that the volume of termiticide used meets the application rate.

Application Equipment

A listing of equipment to be used.

Warranty; G

Copy of Contractor's warranty.

SD-06 Test Reports

Soil Moisture

Soil moisture test result.

Quality Assurance

Pest Management Report and copies of daily records signed by an officer of the Contractor.

SD-07 Certificates

Qualifications; G

Qualifications and state license number of the termiticide applicator.

1.3 QUALIFICATIONS

For the application of pesticides, the Contractor shall use the services of a subcontractor whose principal business is pest control. The subcontractor shall be licensed and certified in the state where the work is to be performed. Termiticide applicators shall also be certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control.

1.4 SAFETY REQUIREMENTS

Formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Contracting Officer's Technical Representative, and fit the filling hose with a backflow preventer meeting local plumbing codes or standards. The filling operation shall be under the direct and continuous observation of a contractor's representative to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application. Dispose of used pesticide containers off Government property.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Termiticide material shall be delivered to the site in the original unopened containers bearing legible labels indicating the EPA registration number and manufacturer's registered uses. All other materials to be used on site for

the purpose of termite control shall be delivered in new or otherwise good condition as supplied by the manufacturer or formulator.

1.5.2 Storage

Materials shall be stored in designated areas and in accordance with manufacturer's labels. Termiticides and related materials shall be kept under lock and key when unattended.

1.5.3 Handling

Termiticides shall be handled in accordance with manufacturer's labels. Manufacturer's warnings and precautions shall be observed. Materials shall be handled preventing contamination by dirt, water, and organic material. Protect termiticides from sunlight as recommended by the manufacturer.

1.6 INSPECTION

Termiticides shall be inspected upon arrival at the job site for conformity to type and quality in accordance with paragraph TERMITICIDES. Each label shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or under appropriate regulations of the host county. Other materials shall be inspected for conformance with specified requirements. Unacceptable materials shall be removed from the job site.

1.7 WARRANTY

The Contractor shall provide a 5-year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Warranty shall include annual inspections of the buildings or building additions. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim, the Contractor shall:

a. Retreat the soil and perform other treatment as may be necessary for elimination of subterranean termite infestation;

b. Repair damage caused by termite infestation; and

c. Reinspect the building approximately 180 days after the retreatment.

1.8 QUALITY ASSURANCE

The Contractor shall comply with 7 USC Section 136 for requirements on contractor's licensing, certification, and record keeping. The Contractor shall maintain daily records using Pest Management Maintenance Record, DD Form 1532-1 and submit copies of records when requested by the Contracting Officer's Technical Representative.

Upon completion of this work, submit Pest Management Report. DD Form 1532 identifying target pest, type of operation, brand name and manufacturer of pesticide, formulation, concentration or rate of application used.

PART 2 PRODUCTS

2.1 TERMITICIDES

Termiticides shall be currently registered by the EPA or approved for such use by the appropriate agency of the host county. Non-repellant termiticide shall be selected for maximum effectiveness and duration after application. The selected termiticide shall be suitable for the soil and climatic conditions at the project site.

PART 3 EXECUTION

3.1 TECHNICAL REPRESENTATIVE

The certified installation pest management coordinator shall be the technical representative, shall be present at all meetings concerning treatment measures for subterranean termites, and may be present during treatment application. The command Pest Control Coordinator shall be contacted prior to starting work.

3.2 SITE PREPARATION

Work related to final grades, landscape plantings, foundations, or any other alterations to finished construction which might alter the condition of treated soils, shall be coordinated with this specification.

3.2.1 Ground Preparation

Food sources shall be eliminated by removing debris from clearing and grubbing and post construction wood scraps such as ground stakes, form boards, and scrap lumber from the site, before termiticide application begins.

3.2.2 Verification

Before work starts, the Contractor shall verify that final grades are as indicated and smooth grading has been completed in accordance with Section 31 00 00 EARTHWORK. Soil particles shall be finely graded with particles no larger than 1 inch and compacted to eliminate soil movement to the greatest degree.

3.2.3 Foundation Exterior

The Contractor shall provide written verification that final grading and landscape planting operations will not disturb treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures.

3.2.4 Utilities and Vents

The Contractor shall provide written verification that the location and identity of HVAC ducts and vents, water and sewer lines, and plumbing have been accomplished prior to the termiticide application.

3.3 SITE CONDITIONS

The following conditions shall determine the time of application.

3.3.1 Soil Moisture

Soils to be treated shall be tested immediately before application. Soil moisture content shall be tested to a minimum depth of 3 inches. The soil moisture shall be as recommended by the termiticide manufacturer. The termiticide will not be applied when soil moisture exceeds manufacturer's recommendations because termiticides do not adhere to the soil particles in saturated soils.

3.3.2 Runoff and Wind Drift

Termiticide shall not be applied during or immediately following heavy rains. Applications shall not be performed when conditions may cause runoff or create an environmental hazard. Applications shall not be performed when average wind speed exceeds 10 miles per hour. The termiticide shall not be allowed to enter water systems, aquifers, or endanger humans or animals.

3.3.2.1 Vapor Barriers and Waterproof Membranes

Termiticide shall be applied prior to placement of a vapor barrier or waterproof membrane.

3.3.2.2 Utilities and Vents

Prior to application, HVAC ducts and vents located in treatment area shall be turned off and blocked to protect people and animals from termiticide.

3.3.3 Placement of Concrete

Concrete covering treated soils shall be placed as soon as the termiticide has reached maximum penetration into the soil. Time for maximum penetration shall be as recommended by the manufacturer.

3.4 TERMITICIDE TREATMENT

The Contractor shall submit a Termiticide Application Plan for approval before starting the specified treatment.

3.4.1 Equipment Calibration and Tank Measurement

Immediately prior to commencement of termiticide application, calibration tests shall be conducted on the application equipment to be used and the application tank shall be measured to determine the volume and contents. These tests shall confirm that the application equipment is operating within the manufacturer's specifications and will meet the specified requirements. The Contractor shall provide written certification of the equipment calibration test results within 1 week of testing.

3.4.2 Mixing and Application

Formulating, mixing, and application shall be performed in the presence of the Contracting Officer's Technical Representative or the technical representative. A closed system is recommended as it prevents the termiticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation.

Prior to each day of use, the equipment used for applying termiticides shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.4.3 Treatment Method

For areas to be treated, the Contractor shall establish complete and unbroken vertical and/or horizontal soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Application shall not be made to areas which serve as crawl spaces or for use as a plenum air space.

3.4.3.1 Surface Application

Surface application shall be used for establishing horizontal barriers. Surface applicants shall be applied as a coarse spray and provide uniform distribution over the soil surface. Termiticide shall penetrate a minimum of 1 inch into the soil, or as recommended by the manufacturer.

3.4.3.2 Rodding and Trenching

Rodding and trenching shall be used for establishing vertical soil barriers. Trenching shall be to the depth of the foundation footing. Width of trench shall be as recommended by the manufacturer, or as indicated. Rodding or other approved method may be implemented for saturating the base of the trench with termiticide. Immediately after termiticide has reached maximum penetration as recommended by the manufacturer, backfilling of the trench shall commence. Backfilling shall be in 6 inch rises or layers. Each rise shall be treated with termiticide.

3.4.4 Sampling

The Contracting Officer's Technical Representative may draw from stocks at the job site, at any time and without prior notice, samples of the termiticides used to determine if the amount of active ingredient specified on the label is being applied.

3.5 VERIFICATION OF MEASUREMENT

Once termiticide application has been completed, tank contents shall be measured to determine the remaining volume. The total volume measurement of used contents for the application shall equal the established application rate for the project site conditions. The Contractor shall provide written verification of the measurements.

3.6 CLEAN UP, DISPOSAL, AND PROTECTION

Once application has been completed, the Contractor shall proceed with clean up and protection of the site without delay.

3.6.1 Clean Up

The site shall be cleaned of all material associated with the treatment measures, according to label instructions, and as indicated. Excess and waste material shall be removed and disposed off site.

3.6.2 Disposal of Termiticide

The Contractor shall dispose of residual termiticides and containers off Government property, and in accordance with label instructions and EPA criteria.

3.6.3 Protection of Treated Area

Immediately after the application, the area shall be protected from other use by erecting barricades and providing signage as required or directed. Signage shall be in accordance with Section 10 14 01 EXTERIOR SIGNAGE. Signage shall be placed inside the entrances to crawl spaces and shall identify the space as treated with termiticide and not safe for children and animals.

3.7 CONDITIONS FOR SATISFACTORY TREATMENT

3.7.1 Equipment Calibrations and Measurements

Where results from the equipment calibration and tank measurements tests are unsatisfactory, re-treatment will be required.

3.7.2 Testing

Should an analysis, performed by a third party, indicate that the samples of the applied termiticide contain less than the amount of active ingredient specified on the label, and/or if soils are treated to a depth less than specified or approved, re-treatment will be required.

3.7.3 Disturbance of Treated Soils

Soil and fill material disturbed after treatment shall be re-treated before placement of slabs or other covering structures.

3.7.4 Termites Found Within the Warranty Period

If live subterranean termite infestation or termite damage is discovered during the warranty period, the Contractor shall re-treat the site.

3.8 RE-TREATMENT

Where re-treatment is required, the Contractor shall comply with the requirements specified in paragraph WARRANTY.

-- End of Section --

SECTION 32 05 33

LANDSCAPE ESTABLISHMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush

ASTM INTERNATIONAL (ASTM)

ASTM D 2103	(2005) Standard Specification for Polyethylene Film and Sheeting
ASTM D 5851	(1995; R 2006) Planning and Implementing a Water Monitoring Program

1.2 DEFINITIONS

1.2.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.2.2 Stand of Turf

95 percent ground cover of the established species.

1.2.3 Planter Beds

A planter bed is defined as an area containing one or a combination of the following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, and a mulch topdressing excluding turf. Trees may also be found in planter beds.

1.3 RELATED REQUIREMENTS

Section 32 92 23 SEEDING applies to this section for installation of seed requirements, with additions and modifications herein.

Section 32 93 00 EXTERIOR PLANTS applies to this section for installation of trees, and shrubs, with additions and modifications herein.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

Deliver fertilizer, gypsum, and iron to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, and gypsum may be furnished in bulk with a certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Fertilizer, Lime, Iron, Mulch Storage

Material shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants.

1.5.2.2 Antidessicants Storage

Do not store with fertilizers or other landscape maintenance materials.

1.5.3 Handling

Do not drop or dump materials from vehicles.

1.6 MAINTENANCE

Provide instructions and procedures for watering; promotion of growth, including fertilizing, pruning, and mowing; and integrated pest management. O&M Manuals shall include pictures of planting materials cross referenced to botanical and common names, with a description of the normal appearance in each season.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

Fertilizer for grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.1.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus

8 percent available potassium

2.2 WATER

Source of water shall be approved by the Contracting Officer's Technical Representative, and be of suitable quality for irrigation. Use collected storm water or graywater when available.

2.3 MULCHES TOPDRESSING

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.3.1 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark or shredded hardwood from site when available. Biobased content shall be a minimum of 100 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application. Paper-based hydraulic mulch shall contain a minimum of 100 percent post-consumer recycled content. Wood-based hydraulic mulch shall contain a minimum of 100 percent recycled material.

2.4 PESTICIDES

Pesticides and herbicides are not permitted. Use black sheet polyethylene conforming to ASTM D 2103, minimum thickness 5/32 inch. Submit an Integrated Pest Management Plan, including weed and pest management strategies and proposed alternatives to herbicides and pesticides. Use biological pest controls as approved in the Plan.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include mowing, edging, fertilizing, watering, weeding, pruning, and stake and guy adjusting, for all newly installed landscape areas, unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

The Contractor shall police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Collected debris shall be promptly removed and disposed of at an approved disposal site.

3.1.2 Drainage System Maintenance

The Contractor shall remove all obstructions from surface and subsurface drain lines to allow water to flow unrestricted in swales, gutters, and catch basins. Remove grates and clear debris in catch basins. Open drainage channels are to be maintained free of all debris and vegetation at all times. Edges of these channels shall be clear of any encroachment by vegetation.

3.2 IRRIGATION ESTABLISHMENT PERIOD

The irrigation establishment period will commence on the date that inspection by the Contracting Officer's Technical Representative shows that the newly planted exterior plants have been installed per requirements and shall continue for a period of 90 days.

3.2.1 Water Restrictions

The Contractor shall abide by state, local or other water conservation regulations in force during the establishment period.

3.2.2 Fire Hydrants

To use a fire hydrant for irrigation, the Contractor shall obtain prior clearance from the Contracting Officer's Technical Officer and provide the tools and connections approved for use on fire hydrants. If a fire hydrant is used, Contractor shall provide a reduced pressure backflow preventer for each connection between hose and fire hydrant. Backflow preventer used shall be tested once per month by a certified backflow preventer tester.

3.2.3 Final Acceptance

Upon completion of the irrigation establishment period and final acceptance of groundcover and exterior plants, irrigation equipment shall be removed.

3.3 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the Contracting Officer shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period shall continue for a period of 90 days.

3.3.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed. Inspect areas once a week during the installation and establishment period and perform needed maintenance promptly.

3.3.2 Promotion of Growth

Groundcover shall be maintained in a manner that promotes proper health, growth, natural color. Turf shall have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, and overseed and perform other operations necessary to promote growth, as approved by Contracting Officer's Technical Representative and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.3.3 Mowing

3.3.3.1 Turf

Turf shall be mowed at a uniform finished height. Mow turfed area to a minimum average height of 3-4 inches when average height of grass becomes 6 inches for spring/summer maintenance and to a minimum average height of 3-4 inches when the average height of grass reaches 5 inches for fall and winter maintenance. The height of turf is measured from the soil. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area shall be picked up and disposed. Adjacent paved areas shall be swept/vacuumed clean.

3.3.4 Turf Edging and Trimming

Perimeter of planter bed edges, sidewalks, driveways, curbs, and other paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas such as an edge between turfgrass and a planter bed. Care shall be exercised to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf's mowed. Care shall be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas may be utilized as a temporary means to avoid injury to tree trunks. At the end of the plant establishment period Contractor will be responsible for removing all protective tree collars.

3.3.5 Post-Fertilizer Application

Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies shall be determined by the laboratory soil analysis results the requirements of the particular turf species. Organic fertilizer shall be used. In the event that organic fertilizer is not producing the desired effect, the Contractor shall contract the Contracting Officer's Technical Representative for approval prior to the use of a synthetic type of fertilizer. Fertilizer shall be applied by approved methods in accordance with the manufacturer's recommendations.

3.3.6 Turf and Plant Watering

The Contractor shall perform watering in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, State, and local water agencies and authorities directives. Watering shall be performed regulary from planting to the end of the establishment period. The Contractor shall be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. The Contractor shall abide by state, local or other water conservation regulations or restrictions in force during the establishment period.

3.3.7 Turf Clearance Area

Trees located in turf areas shall be maintained with a growth free clearance of 24 inches from the tree trunk base. The use of mechanical weed whips to accomplish the turf growth free bed area is prohibited.

3.3.8 Replanting

Replant in accordance with Section 32 92 19 SEEDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

3.3.9 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf. Final acceptance of grass areas will be based upon a stand of 95 percent groundcover of established species.

3.3.10 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer's Technical Representative.

3.4 EXTERIOR PLANT ESTABLISHMENT PERIOD

The exterior plant establishment period will commence on the date that inspection by the Contracting Officer shows that the new plants furnished under this contract have been satisfactorily installed and shall continue for a period of 90 days.

3.4.1 Frequency of Maintenance

Begin maintenance immediately after plants have been installed. Inspect exterior plants at least biweekly during the installation and establishment period and perform needed maintenance promptly.

3.4.2 Promotion of Plant Growth and Vigor

Water, prune, fertilize, mulch, adjust stakes, guys and turnbuckles, eradicate weeds and perform other operations necessary to promote plant growth, and vigor.

3.4.3 Planter Bed Maintenance

Planter beds shall be weeded, fertilized, irrigated, kept pest free, turf free, pruned, and mulch levels maintained. Planter beds will not be allowed to encroach into turf areas. A definite break shall be maintained between turf areas and planter beds. Fertilize exterior planting materials to promote healthy plant growth without encouraging excessive top foliar growth. Remove noxious weeds common to the area from planting areas by mechanical means.

3.4.3.1 Shrub Selective Maintenance

In addition to the above requirements, shrubs shall be selectively pruned, and shaped for health and safety when the following conditions exist: Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel; Remove dead, damaged or diseased branches or limbs; where shrub growth obstructs pedestrian walkways; where shrub growth is found growing against or over structures; where shrub growth permits concealment of unauthorized persons. All pruning debris shall be disposed of in a proper manner.

3.4.3.2 Tree Maintenance

Tree maintenance shall include adjustment of stakes, ties, guy supports and turnbuckles, watering, fertilizing, pest control, mulching, pruning for health and safety and fall leaf cleanup. Fertilize exterior trees to promote healthy plant growth without encouraging excessive top foliar growth. Stakes, ties, guy supports and turnbuckles shall be inspected and adjusted to avoid girdling and promote natural development. All trees within the project boundaries, regardless of caliper, shall be selectively pruned for safety and health reasons. These include but are not limited to removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced. Pruning of all trees including palm trees shall be accomplished by or in the presence of a certified member of the International Society of Arboriculture and in accordance with ANSI Z133.1. All pruning debris generated shall be disposed of in a proper manner.

3.4.4 Removal of Dying or Dead Plants

Remove dead and dying plants and provide new plants immediately upon commencement of the specified planting season, and replace stakes, guys, mulch and eroded earth mound water basins. No additional plant establishment period will be required for replacement plants beyond the original warranty period. A tree shall be considered dying or dead when the main leader has died back, or a minimum of 20 percent of the crown has died. A shrub or ground cover shall be considered dying or dead when a minimum of 20 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine the cause for dying plant material and shall provide recommendations for replacement. The Contractor shall determine the cause for dying plant material and provide recommendations for replacement.

3.4.5 Tracking of Unhealthy Plants

Note plants not in healthy growing condition, as determined by the Contracting Officer's Technical Representative, and as soon as seasonal conditions permit, remove and replace with plants of the same species and sizes as originally specified. Install replacement plantings in accordance with Section 32 93 00 EXTERIOR PLANTS.

3.4.6 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final inspection will be based upon satisfactory health and growth of plants and on the following:

3.4.6.1 Total Plants on Site

Plants have been accepted and required number of replacements have been installed.

3.4.6.2 Mulching and Weeding

Planter beds and earth mound water basins are properly mulched and free of weeds.

3.4.6.3 Tree Supports

Stakes guys and turnbuckles are in good condition.

3.4.6.4 Remedial Work

Remedial measures directed by the Contracting Officer's Technical Representative to ensure plant material survival and promote healthy growth have been completed.

3.4.7 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer' Technical Representative.

3.5 FIELD QUALITY CONTROL

3.5.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations shall be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Results of site observation visits shall be submitted to the Contracting Officer's Technical Representative within 7 calendar days of each site observation visit.

3.5.2 Plant Quantities

The Contractor shall provide Contracting Officer's Technical Representative with the number of plant quantities. In addition, provide total exterior area of hardscape and landscaping such as turf and total number of shrubs.

3.5.3 Tree Staking and Guying Removal

The Contractor shall remove all stakes and guys from all project trees at the end of the establishment period.

-- End of Section --

SECTION 32 10 00

BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 230	(1968; R 2000) Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures
AASHTO T 30	(2007) Mechanical Analysis of Extracted Aggregate

ASTM INTERNATIONAL (ASTM)

ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2172	(2005) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2005) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

STATE OF GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)

GDOT	(2001) Standard Specifications, Construction of Roads and Bridges

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Local/Regional Materials; (LEED)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-06 Test Reports

Trial batch reports;

Mix design;

Asphalt concrete;

Density;

Thickness;

Straightedge test;

Submit reports for testing specified under paragraph entitled "Field Quality Control."

SD-07 Certificates

Asphalt concrete;

Submit certificates, signed by the producer, that paving materials and incidental construction items conform to specification requirements.

1.3 QUALITY ASSURANCE

1.3.1 Regulatory Requirements

Provide work and materials in accordance with applicable requirements of GDOT. Sections and Paragraphs 400 and 828 mentioned herein refer to those specifications. Paragraphs in GDOT entitled "Measurement" and "Payment" shall not apply.

1.3.2 Modification of References

Where term "Engineer" is used in GDOT it shall be construed to mean Contracting Officer's Technical Representative. Where term "state" is used, it shall mean "Federal Government".

1.3.3 Trial Batch

Submit current bituminous design reports for all mix types proposed for use on the project.

1.3.4 Mix Design

Submit results of laboratory tests performed on each mix design. Testing shall have been accomplished not more than one year prior to date of material placement.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not produce or place bituminous concrete when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.

1.5 SUSTAINABLE DESIGN REQUIREMENTS

1.5.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE

Provide asphalt concrete in accordance with the applicable requirements of the GDOT, except where specified otherwise. Recycled asphalt pavement material may be used as permitted by GDOT.

2.2 BASE COURSE

GDOT, materials for construction of the base course shall be in accordance with Section 815.2.02.

2.3 SURFACE COURSE

GDOT, materials for construction of the surface course shall be in accordance with Section 828.2.02Type 9.5 mm SMA.

2.4 STRIPING

GDOT, materials for paint striping shall be in accordance with Section 652 and Section 870.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Excavation and Filling

Excavation and filling to establish elevation of subgrade is specified in Section 31 00 00 EARTHWORK.

3.2 CONSTRUCTION

Provide construction in accordance with the applicable requirements of the GDOT, except where indicated or specified otherwise.

3.2.1 Subgrade

Preparation of subgrade shall be in accordance with Section 31 00 00 EARTHWORK. Verify compacted subgrade, granular base, or stabilized soil is acceptable and ready to support paving and imposed loads.

3.2.2 Base Course

GDOT, methods of construction of the base course shall be in accordance with Section 310.

3.2.3 Surface Course

GDOT, methods of construction of the surface course shall be in accordance with Section 400. Placement will not be permitted unless the Contractor has a working asphalt thermometer on site.

3.2.4 Striping

GDOT, provide paint striping in accordance with Section 870. Allow bituminous pavement to cure for at least 21 days before paint is applied. Pavement shall be thoroughly clean and entirely free of loose sand, stones, dust, oil, grease, water, and other substances that will be deleterious to the paint or will adversely affect the adhesion of the paint. Do not apply paint during high wind (over 15 miles per hour) or high humidity (over 70 percent). Apply paint only when ambient temperature is 40 degrees F or above and rising but not more than 95 degrees F. Dimensions and arrangement of striping shall be as indicated. Apply paint to a wet film thickness of 0.015 inch by means of conventional traffic line striping equipment. Traffic shall not be permitted to use the painted areas for a minimum of 30 minutes after painting of lines has been completed.

3.3 FIELD QUALITY CONTROL

Sample shall be taken by Contractor as specified herein. Contractor shall replace pavement where sample cores have been removed. Submit 2 pavement cores when using the in-place nuclear density method.

3.3.1 Testing

3.3.1.1 Bituminous Mix Testing

Take two samples per day per mix type at plant or from truck. Test uncompacted mix for extraction in accordance with ASTM D 2172 and sieve analysis in accordance with AASHTO T 30. Test samples for stability and flow in accordance with ASTM D 1559. When two consecutive tests fail to meet requirements of specifications, cease placement operations and test a new trial batch prior to resumption of placement operations. Submit 2 per day of each mix type. When two tests on uncompacted mix fail submit new trial batch for approval.

3.3.1.2 Testing of Pavement Course

a. Density: Determine density of pavement by testing cores obtained from the surface course in accordance with AASHTO T 230. Take three cores at location designated by Contracting Officer's Technical Representative for each 200 tons, or fraction thereof, of asphalt placed. Deliver cores undisturbed and undamaged to laboratory and provide test results within 48 hours of each day placement of paving materials.

b. Thickness: Determine thickness of the surface course from cores taken for density test.

c. Straightedge Test: Test compacted surface course with a straightedge as work progresses. Apply straightedge parallel with and at right angles to center line after final rolling. Variations in surface course surface shall not be more than 1/4 from the lower edge of the 10 foot straightedge.

d. Noncompliant pavement shall be replaced or corrected as directed by the Contracting Officer's Technical Representative at no additional expense to the Government.

3.4 WASTE MANAGEMENT

Protect excess material from contamination and return to manufacturer, or reuse on-site for walkways, patching, ditch beds, speed bumps, or curbs.

-- End of Section --

SECTION 32 16 13

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(2005) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

ASTM INTERNATIONAL (ASTM)

ASTM A 185/A 185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 615/A 615M	(2007) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2005a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 171	(2003) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(2007) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 309	(2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2006) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1751	(2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

ASTM D 5893	(2004) Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete;

Copies of certified delivery tickets for all concrete used in the construction.

SD-06 Test Reports

Field Quality Control;

Copies of all test reports within 24 hours of completion of the test.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F.Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F at any time.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer's Technical Representative shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.1.1 Slump

The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143/C 143M.

2.1.2 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615/A 615M. Wire mesh reinforcement shall conform to ASTM A 185/A 185M.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

Joint sealant, cold-applied shall conform to ASTM C 920 or ASTM D 5893.

2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted as directed.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends

shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of 1/4 inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.

3.4.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.4.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D 1752 or building paper. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant. Joint sealant shall be gray or stone in color. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.4.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.5 CURING AND PROTECTION

3.5.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be

on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.5.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.5.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.5.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet/gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing

compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.5.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.5.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.6 FIELD QUALITY CONTROL

3.6.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.6.2 Concrete Testing

3.6.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.6.2.2 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.6.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section.

3.6.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.7 SURFACE DEFICIENCIES AND CORRECTIONS

3.7.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.7.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.7.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

3.7.4 Corrections

Noncompliant concrete shall be removed and replaced or corrected as directed by the Contracting Officer's Technical Representative at no additional expense to the Government.

-- End of Section --

SECTION 32 17 24.00 10

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952	(Rev E) Paint, Traffic and Airfield Markings, Waterborne

1.2 SYSTEM DESCRIPTION

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Submit lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.2.1 Paint Application Equipment

1.2.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified.Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.2.1.2 Hand-Operated, Push-Type Machines

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.2.2 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.2.3 Surface Preparation Equipment

1.2.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.2.3.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

1.2.4 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.2.4.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.2.4.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradable residue.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing

1.4 QUALITY ASSURANCE

1.4.1 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.4.2 Maintenance of Traffic

1.4.2.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.5 DELIVERY, STORAGE, AND HANDLING

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.6 ENVIRONMENTAL REQUIREMENTS

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, parking areas, and streets shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Submit certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers in the presence of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Thoroughly clean surfaces to be marked before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Remove existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.2 Cleaning Concrete Curing Compounds

On new portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified. Provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

a. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet/gallon.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Raised Reflective Markers

Prefabricated markers shall be aligned carefully at the required spacing and permanently fixed in place by means of epoxy resin adhesives. To insure good bond, pavement in areas where markers will be set shall be thoroughly cleaned by sandblasting and use of compressed air prior to applying adhesive.

3.2.3 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the

specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

3.3 MARKING REMOVAL

Pavement marking, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

-- End of Section --

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 602	(2007) Agricultural Liming Materials
ASTM D 4427	(2007) Peat Samples by Laboratory Testing
ASTM D 4972	(2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch;

Fertilizer;

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Sulfur, Iron and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer sulphur, iron and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer, Sulfur, Iron and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer's Technical Representative.

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	Feb 15 - June 30
Season 2	Nov 1 - Jan 31
Temporary Seeding 1	Aug 15 - Mar 31
Temporary Seeding 2	Apr 1 - July 15

2.1.3 Seed Purity

Botanical Name	Common Name	Min. Percent Pure Seed
Cynodon Daclylon	Common Bermuda (Hulled or Unhulled)	100%
Lolium Mutliflorum	Annual Ryegrass	100%
Secale Cereale	Rye	100%
Panicum Fasciculalum	Browntop Millet	100%

2.1.4 Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
Season 1	Common Bermuda (Hulled)	100%
Season 2	Common Bermuda (Unhulled)	60%
	Rye	40%
Temporary Seeding 1	Annual Ryegrass	100%
Temporary Seeding 2	Browntop Millet	100%

Proportion seed mixtures by weight. Temporary seeding must later be replaced by Season 1 or Season 2 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 or Season 2 apply for temporary seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade hydrate or burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 110 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

20 percent available nitrogen
10 percent available phosphorus
10 percent available potassium

2.4.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the following minimum percentages, by weight, of plant food nutrients.

20 percent available nitrogen
10 percent available phosphorus
10 percent available potassium

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.5.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.6 WATER

Source of water shall be approved by Contracting Officer's Technical Representative and of suitable quality for irrigation, containing no elements toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of off-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters or soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer's Technical Representative. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer's Technical Representative stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be broadcasted and drop seeding or hydroseeding.

3.2.2.1 Broadcast and Drop Seeding

Seed shall be uniformly broadcast at the rate of 1500pounds per acre. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.2.2 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of 1500pounds per acre. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.2.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.2.3.3 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer's Technical Representative.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RENOVATION OF EXISTING TURF AREA

3.4.1 Overseeding

Apply seed in accordance with applicable portions of paragraph entitled "Seed Application Method" at rates in accordance with paragraph entitled "Seed Composition."

3.5 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 32 93 00

EXTERIOR PLANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance
ANSI Z133.1	(2006) Arboricultural Operations - Safety Requirements for Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush
ANSI Z60.1	(1996) Nursery Stock

ASTM INTERNATIONAL (ASTM)

ASTM A 580/A 580M	(2006) Standard Specification for Stainless Steel Wire
ASTM D 4972	(2001; R 2007) pH of Soils
ASTM D 5852	(2000; R 2007) Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
ASTM D 6629	(2001; R 2007) Selection of Methods for Estimating Soil Loss by Erosion

L.H. BAILEY HORTORIUM (LHBH)

LHBH	(1976) Hortus Third

1.2 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, Section 32 92 23 SEEDING, and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Organic Mulch Materials

Mulch;

Fertilizer;

Weed control fabric;

Staking Material
Ground Stakes;

Metal anchors;

SD-06 Test Reports

Topsoil composition tests;

SD-07 Certificates

Nursery certifications;

Indicate names of plants in accordance with the LHBH, including type, quality, and size.

1.4 QUALITY ASSURANCE

1.4.1 Topsoil Composition Tests

Commercial test from an independent testing laboratory including basic soil groups (moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D 4972), soil salinity), secondary nutrient groups (calcium, magnesium, sodium, Sodium Absorption Ratio (SAR)), micronutrients (zinc, manganese, iron, copper), toxic soil elements (boron, chloride, sulfate), cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being transplanted. Soil required for each test shall include a maximum depth of 18 inches of approximately 1 quart volume for each test. Areas sampled should not be larger than 1 acre and should contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.

1.4.2 Nursery Certifications

a. Indicate on nursery letterhead the name of plants in accordance with the LHBH, including botanical common names, quality, and size.

b. Inspection certificate.

c. Mycorrhizal fungi inoculum for plant material treated

1.4.3 State Landscape Contractor's License

Construction company shall hold a landscape contractors license in the state of Georgia and have a minimum of five years landscape construction experience. Submit copy of license and three references for similar work completed in the last five years.

1.4.4 Not used

1.4.5 Not used

1.4.6 Not used

1.4.7 Pre-Installation Meeting

Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this section. Review conditions of operations, procedures and coordination with related work. Agenda shall include the following:

a. Tour, inspect, and discuss conditions of planting materials.

b. Review planting schedule and maintenance.

c. Review required inspections.

d. Review environmental procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Branched Plant Delivery

Deliver with branches tied and exposed branches covered with material which allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.

1.5.1.2 Soil Amendment Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulfur, iron, and lime may be furnished in bulk with a certificate indicating the above information. Store in dry locations away from contaminates.

1.5.1.3 Plant Labels

Deliver plants with durable waterproof labels in weather-resistant ink. Provide labels stating the correct botanical and common plant name and variety as applicable and size as specified in the list of required plants. Attach to plants, bundles, and containers of plants. Groups of plants may be labeled by tagging one plant. Labels shall be legible for a minimum of 60 days after delivery to the planting site.

1.5.2 Storage

1.5.2.1 Plant Storage and Protection

Store and protect plants not planted on the day of arrival at the site as follows:

a. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted.

b. Heel-in bare root plants.

c. Protect balled and burlapped plants from freezing or drying out by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.

d. Keep plants in a moist condition until planted by watering with a fine mist spray.

e. Do not store plant material directly on concrete or bituminous surfaces.

1.5.2.2 Fertilizer, Gypsum, pH Adjusters and Mulch Storage

Store in dry locations away from contaminants.

1.5.2.3 Topsoil

Prior to stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.4 Weed Control Fabric

Store materials on site in enclosures or under protective covering in dry location. Store under cover out of direct sunlight. Do not store materials directly on ground.

1.5.3 Handling

Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped bare root, balled and potted, processed balled and/or in-ground fabric bag grown plants carefully to avoid damaging or breaking the earth ball or root structure. Do not handle plants by the trunk or stem. Remove damaged plants from the site.

1.5.4 TIME LIMITATION

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum of 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum of 24 hours.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.

1.6.1 Planting Dates

1.6.1.1 Deciduous Material

Deciduous material from 3/1 to 5/15 for spring planting and from 10/1 to 11/30 for fall planting.

1.6.1.2 Evergreen Material

Evergreen material from 3/1 to 4/30 for spring planting and from 9/1 to 9/30 for fall planting.

1.6.2 Restrictions

Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit

1.7 GUARANTEE

All plants shall be guaranteed for one year beginning on the date of inspection by the Contracting Officer's Technical Representative to commence the plant establishment period, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Government or by weather conditions unusual for the warranty period.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Regulations and Varieties

Existing trees and shrubs to remain shall be protected and a planting plan be arranged around them.Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Each plant or group of planting shall have a "key" number indicated on the nursery certifications of the plant schedule. Furnish plants, including turf grass, grown under climatic conditions similar to those in the locality of the project. Plants specified shall be low maintenance varieties, tolerant of site's existing soils and climate. Spray plants budding into leaf or having soft growth with an antidesiccant before digging. Plants of the same specified size shall be of uniform size and character of growth. Plants shall be chosen with their mature size and growth habit in mind to avoid over-planting and conflict with other plants, structures or underground utility lines. All plants shall comply with all Federal and State Laws requiring inspection for plant diseases and infestation.

2.1.2 Shape and Condition

Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having a healthy, normal, and undamaged root system.

2.1.2.1 Deciduous Trees and Shrubs

Symmetrically developed and of uniform habit of growth, with straight boles or stems, and free from objectionable disfigurements.

2.1.2.2 Evergreen Trees and Shrubs

Well developed symmetrical tops with typical spread of branches for each particular species or variety.

2.1.3 Plant Size

Minimum sizes measured after pruning and with branches in normal position, shall conform to measurements indicated, based on the average width or height of the plant for the species as specified in ANSI Z60.1. Plants larger in size than specified may be provided with approval of the Contracting Officer's Technical Representative. When larger plants are provided, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.

2.1.4 Root Ball Size

All box-grown, field potted, field boxed, collected, plantation grown, bare root, balled and burlapped, container grown, processed-balled, and in-ground fabric bag-grown root balls shall conform to ANSI Z60.1. All wrappings and ties shall be biodegradable. Root growth in container grown plants shall be sufficient to hold earth intact when removed from containers. Root bound plants will not be accepted.

2.1.4.1 Mycorrhizal fungi inoculum

Before shipment, root systems shall contain mycorrhizal fungi inoculum.

2.1.5 Growth of Trunk and Crown

2.1.5.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANSI Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.

2.1.5.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANSI Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.5.3 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANSI Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

2.2 TOPSOIL

2.2.1 Existing Soil

Modify to conform to requirements specified in paragraph entitled "Composition" of specification Section 32 92 19, SEEDING.

2.3 SOIL CONDITIONERS

Provide as found in paragraph entitled "Soil Conditioners", Section 32 92 19, SEEDING.

2.4 PLANTING SOIL MIXTURES

100 percent topsoil as specified in Section 32 92 19, SEEDING.

2.5 FERTILIZER

Fertilizer for grasses is not permitted.
Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.5.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus
8 percent available potassium

2.5.2 Fertilizer Tablets

Organic, plant tablets composed of tightly compressed fertilizer chips forming a tablet that is insoluble in water, is designed to provide a continuous release of nutrients for at least 24 months and contains the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
4 percent available phosphorus
8 percent available potassium

2.6 WEED CONTROL FABRIC

2.6.1 Roll Type Polypropylene or Polyester Mats

Fabric shall be woven, needle punched or non-woven and treated for protection against deterioration due to ultraviolet radiation. Fabric shall be minimum 99 percent opaque to prevent photosynthesis and seed germination from occurring, yet allowing air, water and nutrients to pass thru to the

roots. Minimum weight shall be 5 ounces per square yard with a minimum thickness of 20 mils with a 20 year (minimum) guarantee.

2.7 MULCH

Free from noxious weeds, mold, pesticides, or other deleterious materials.

2.7.1 Organic Mulch Materials

Wood cellulose fiber, wood chips, ground or shredded bark or shredded hardwood from site when available. Biobased content shall be a minimum of 100 percent. Wood cellulose fiber shall be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of materials application. Paper-based hydraulic mulch shall contain a minimum of 100 percent post-consumer recycled content. Wood-based hydraulic mulch shall contain a minimum of 100 percent recycled material.

2.8 STAKING AND GUYING MATERIAL

2.8.1 Staking Material

2.8.1.1 Tree Support Stakes

Rough sawn hard wood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Stakes shall be minimum 2 inches square or 2 1/2 inch diameter by 8 feet long, pointed at one end.

2.8.1.2 Ground Stakes

100 percent post-consumer recycled content plastic, 2 inches square are by 3 feet long, pointed at one end.

2.8.2 Guying Material

2.8.2.1 Guying Wire

12 gauge annealed galvanized steel, ASTM A 580/A 580M.

2.8.2.2 Guying Cable

Minimum five-strand, 3/16 inch diameter galvanized steel cable.

2.8.3 Hose Chafing Guards

New or used 2 ply 3/4 inch diameter reinforced rubber or plastic hose, black or dark green, all of same color.

2.8.4 Flags

White surveyor's plastic tape, 12 inches long, fastened to guying wires or cables.

2.8.5 Turnbuckles

Galvanized or cadmium-plated steel with minimum 3 inch long openings fitted with screw eyes. Eye bolts shall be galvanized or cadmium-plated steel with one inch diameter eyes and screw length 1 1/2 inches, minimum.

2.8.6 Metal Anchors

2.8.6.1 Driven Anchors

Malleable iron, arrow shaped, galvanized, sized as follows:

Tree Caliper	Anchor Size
2 inches and under	3 inches
3 to 6 inches	4 inches
6 to 8 inches	6 inches
8 to 10 inches	8 inches
10 to 12 inches	10 inches

2.8.6.2 Screw Anchors

Steel, screw type with welded-on 3 inch round helical steel plate, minimum 3/8 inch diameter, 15 inches long.

2.9 NOT USED

2.10 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.10.1 Erosion Control Blanket

100 percent agricultural straw stitched with a degradable nettings, designed to degrade within 18 months.

2.10.2 Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.10.3 Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inch square.

2.10.4 Not used

2.10.5 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

2.11 WATER

Source of water to be approved by Contracting Officer's Technical Representative and suitable quality for irrigation and shall not contain elements toxic to plant life, including acids, alkalis, salts, chemical

pollutants, and organic matter. Use collected storm water or graywater when available.

2.12 NOT USED

2.13 SOURCE QUALITY CONTROL

The Contracting Officer's Technical Representative will inspect plant materials at the project site and approve them. Tag plant materials for size and quality.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide soil preparation, fertilizing, tree, shrub, and planting, staking and guying, weed control fabric,, erosion control material and installation and a mulch topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 PREPARATION

3.2.1 Protection

Protect existing and proposed landscape features, elements, and sites from damage or contamination. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than the drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.

3.2.2 Layout

Stake out approved plant material locations and planter bed outlines on the project site before digging plant pits or beds. The Contracting Officer's Technical Representative reserves the right to adjust plant material locations to meet field conditions. Do not plant closer than 36 inches to a building wall, pavement edge, fence or wall edge and other similar structures.

3.2.3 Erosion Control

Provide erosion control and seeding with native plant species to protect slopes.

3.2.4 Soil Preparation

3.2.4.1 pH Adjuster Application Rates

Apply pH adjuster at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.4.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.2.4.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.3 PLANT BED PREPARATION

Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Depth of plant pit excavation shall be as indicated and provide proper relation between top of root ball and finished grade. Install plant material as specified in paragraph entitled "Plant Installation." Do not install trees within 10 feet of any building walls.

3.4 PLANT INSTALLATION

3.4.1 Individual Plant Pit Excavation

Excavate pits at least twice as large in diameter as the size of ball or container to depth shown.

3.4.2 Plant Beds with Multiple Plants

Excavate plant beds continuously throughout entire bed as outlined to depth shown.

3.4.3 Handling and Setting

Move plant materials only by supporting the root ball. Set plants on hand compacted layer of prepared backfill soil mixture 6 inches thick and hold plumb in the center of the pit until soil has been tamped firmly around root ball. Set plant materials, in relation to surrounding finish grade, level to the depth at which they were grown in the nursery, collecting field or container. Replace plant material whose root balls are cracked or damaged either before or during the planting process.

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas.

3.4.3.1 Balled and Burlapped Stock

Backfill with prepared soil mixture and topsoil to approximately half the depth of ball and then tamp and water. Carefully remove or fold back excess burlap and tying materials from the top a minimum 1/3 depth from the top of the rootball. Tamp and complete backfill, place mulch topdressing, and water. Remove wires and non-biodegradable materials from plant pit prior to backfill operations.

3.4.3.2 Bare-Root Stock

Plant so roots are arranged in a natural position. Place roots in water a minimum of 30 minutes prior to planting. Carefully work prepared soil mixture and topsoil among roots. Tamp remainder of backfill, place mulch topdressing and water.

3.4.3.3 Container Grown Stock

Remove from container and prevent damage to plant or root system.

3.4.4 Earth Mounded Watering Basin for Individual Plant Pits

Form with topsoil around each plant by replacing a mound of topsoil around the edge of each plant pit. Watering basins shall be 6 inches deep for trees and 4 inches deep for shrubs. Eliminate basins around plants in plant beds containing multiple plants.

3.4.5 Weed Control Fabric Installation

Remove grass and weed vegetation, including roots, from within the area enclosed by edging. Completely cover areas enclosed by edging with specified weed control fabric prior to placing mulch layer. Overlap cut edges 6 inches.

3.4.6 Erosion Control Material

Install in accordance with manufacturer's instructions.

3.4.7 Placement of Mulch Topdressing

Place specified mulch topdressing on top of weed control fabric covering total area enclosed by edging. Place mulch topdressing to a depth of 3 inches.

3.4.8 Mulch Topdressing

Provide mulch topdressing over entire planter bed surfaces and individual plant surfaces including earth mound watering basin around plants to a depth of 3 inches after completion of plant installation and before watering. Keep mulch out of the crowns of shrubs. Place mulch a minimum 6 inches away from trunk of shrub or tree. Place on top of any weed control fabric.

3.4.9 Fertilization

3.4.9.1 Fertilizer Tablets

Place fertilizer planting tablets evenly spaced around the plant pits to the manufacturer's recommended depth.

3.4.9.2 Granular Fertilizer

Apply granular fertilizer as a top coat prior to placing mulch layer and water thoroughly.

3.4.10 Watering

Start watering areas planted as required by temperature and wind conditions. Slow deep watering shall be used. Apply water at a rate sufficient to

ensure thorough wetting of soil to a depth of 12 inches without run off or puddling. Watering of other plant material or adjacent areas shall be prevented.

3.4.11 Staking and Guying

3.4.11.1 Staking

Stake plants with the number of stakes indicated complete with double strand of 12 gage guy wire as detailed. Attach guy wire half the tree height but not more than 5 feet high. Drive stakes to a depth of 2 1/2 to 3 feet into the ground outside the plant pit. Do not injure the root ball. Use hose chafer guards where guy wire comes in contact with tree trunk.

3.4.11.2 Guying

Guy plants as indicated.

3.4.11.3 Chafing Guards

Use hose chafing guards, as specified where guy wire cable will contact the plant.

3.4.11.4 Deadmen

Place deadmen minimum 18 inches below ground surface. Place equal distance from tree trunk and around the plant pit.

3.4.11.5 Wood Ground Stakes

Drive wood ground stakes into firm ground outside of plant pit with top of stake flush with ground. Place equal distance from tree trunk and around the plant pit.

3.4.11.6 Iron Anchors

Drive malleable iron anchors into firm ground outside of plant pit a minimum 30 inches below finish grade. Place equal distance from tree trunk and around the plant pit.

3.4.11.7 Steel Screw Anchors

Insert steel screw anchors as recommended in manufacturer's data. Place equal distance from tree trunk and around the plant pit.

3.4.11.8 Flags

Securely fasten flags on each guy wire and cable approximately two-thirds of the distance up from ground level.

3.4.12 Pruning

Prune in accordance with safety requirement of ANSI Z133.1.

3.4.12.1 Trees and Shrubs

Remove dead and broken branches. Prune to correct structural defects only. Retain typical growth shape of individual plants with as much height and spread as practical.Do not cut central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars shall remain in place. Pruning shall be accomplished by trained and experienced personnel and shall be accordance with ANSI A300.

3.4.12.2 Wound Dressing

Do not apply tree wound dressing to cuts.

3.5 RESTORATION AND CLEAN UP

3.5.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.5.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite at an approved landfill, recycling center, or composting center. Adjacent paved areas shall be cleared.

-- End of Section --

SECTION 33 11 00

WATER DISTRIBUTION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2004) Hypochlorites
AWWA B301	(2004) Liquid Chlorine
AWWA C104/A21.4	(2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2003) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153/A21.53	(2006) Ductile-Iron Compact Fittings for Water Service
AWWA C500	(2002; R 2003) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(2005) Dry-Barrel Fire Hydrants
AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C800	(2005) Underground Service Line Valves and Fittings
AWWA C900	(2007) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASME B16.26	(2006) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

ASTM INTERNATIONAL (ASTM)

ASTM B 61	(2002) Standard Specification for Steam or Valve Bronze Castings
ASTM B 62	(2002) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(2004e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2774	(2004e1) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 402	(2005) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 325	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 49	(2003) Hazardous Chemicals Data
NFPA 704	(2006) Identification of the Hazards of Materials for Emergency Response

UNDERWRITERS LABORATORIES (UL)

UL 246	(1993; Rev thru Dec 1998) Hydrants for Fire-Protection Service
UL 262	(2004) Standard for Gate Valves for Fire-Protection Service

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)

1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 6 inch lines of ductile-iron or polyvinyl chloride (PVC) plastic pipe. Provide water main accessories, gate valves as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines indicated as 2-1/2 inch lines from water distribution main to building service at the point indicated. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances as specified and where indicated.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping Materials;

Water distribution main piping, fittings, joints, valves, and coupling;

Hydrants;

Valve boxes;

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

SD-06 Test Reports

Bacteriological Disinfection; G

Test results from commercial laboratory verifying disinfection

SD-07 Certificates

Fire hydrants;

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.4.2.1 Miscellaneous Plastic Pipe and Fittings

Handle Polyvinyl Chloride (PVC), pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Ductile-Iron Piping

a. Pipe and Fittings: Pipe, AWWA C151/A21.51, Pressure Class 150. Fittings, AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104/A21.4, standard thickness.

b. Joints and Jointing Material:

(1) Joints: Joints for pipe and fittings shall be push-on joints or mechanical joints.

(2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111/A21.11.

(3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111/A21.11.

2.1.1.2 Polyvinyl Chloride (PVC) Plastic Piping

a. Pipe and Fittings: Pipe, AWWA C900, shall be plain end or gasket bell end, Pressure Class 150 (DR 18) with cast-iron-pipe-equivalent OD.

b. Fittings for PVC pipe: Fittings shall be gray iron or ductile iron, AWWA C110/A21.10 or AWWA C153/A21.53, and have cement-mortar lining, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe specified in this paragraph. Iron fittings and specials shall be cement-mortar lined in accordance with AWWA C104/A21.4.

c. Joints and Jointing Material: Joints for pipe shall be push-on joints, ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints ASTM D 3139, or compression-type joints/mechanical joints, ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe, ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints.

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, (2) AWWA C509 shall be nonrising stem type with mechanical-joint ends or resilient-seated gate valves 3 to 12 inches in size, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have 0-ring stem seals.Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.

2.1.2.2 Fire Hydrants

Dry-barrel type. Paint hydrants with at least one coat of primer and two coats of red enamel paint.

a. Dry-Barrel Type Fire Hydrants: Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, shall have 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Inlet shall have mechanical-joint or push-on joint end; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap

nuts, and threads on hose and pumper connections shall be as specified in AWWA C502. Hydrants indicated as "traffic type," shall have frangible sections as mentioned in AWWA C502. The traffic type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and upper and lower sections of hydrant stem and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall operate properly under normal conditions.

2.1.2.3 Valve Boxes

Provide a valve box for each gate valve. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Cast-iron boxes shall have a minimum cover and wall thickness of 3/16 inch. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.4 Tracer Wire for Nonmetallic Piping

Provide as specified in Section 31 00 00, EARTHWORK.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation (NSF) for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer.

a. Polyvinyl Chloride (PVC) Plastic Piping with Screw Joints: ASTM D 1785, Schedule 40; or ASTM D 2241, with SDR as necessary to provide 150 psi minimum pressure rating. Fittings, ASTM D 2466 or ASTM D 2467. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12; PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing, ASTM D 2564. Pipe couplings, when used shall be tested as required by ASTM D 2464.

b. Polyvinyl Chloride (PVC) Plastic Piping with Elastomeric-Gasket Joints:

   Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified.

c. Polyvinyl Chloride (PVC) Plastic Piping with Solvent Cement Joints:

   Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

2.2.2.2 Service Clamps

Service clamps used for repairing damaged cast-iron, steel, PVC or asbestos-cement pipe shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.2.2.3 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

2.2.2.4 Gate Valves Smaller than 3 Inch in Size

Gate valves smaller than 3 inch size MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.

2.2.2.5 Curb Boxes

Provide a curb box for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

2.2.2.6 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.2.2.7 Meters

Contractor shall supply and install in accordance with the Brunswick-Glynn Joint Water and Sewer Commission.

2.2.2.8 Meter Boxes

Contractor shall supply and install in accordance with the Brunswick-Glynn Joint Water and Sewer Commission.

2.2.2.9 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sewer line. Do not lay water lines in the same trench with electric wiring.

Where water piping is required to be installed within 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casting Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00.

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings.Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted.Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate

recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 feet.

3.1.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.1.5 Connections to Existing Water Lines

All connections to potable water lines 12 inches in diameter and smaller using corporation stops or tapping sleeves and tapping valves shall only be made by Brunswick-Glynn Joint Water and Sewer Commission approved Contractors. Coordinate this work, via the Contracting Officer's Technical Representative, with Brunswick-Glynn Joint Water and Sewer Commission Personnel. Provide corporation stops, tapping sleeves and tapping valves, and all other material, labor, and equipment necessary for the connection. Perform all earthwork and disinfection work at the connection prior to installation of the tapping machine by the Government. Perform the disinfection work in the presence of the Brunswick-Glynn Joint Water and Sewer Commission and FLETC personnel. Make connections to existing water lines in the presence of the Brunswick-Glynn Joint Water and Sewer Commission and FLETC personnel.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.

b. Allowable Deflection: The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size

and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94/C 94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.2 Installation of PVC Plastic Water Main Pipe

Installation of PVC Plastic Water Main Pipe and Associated Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines"; with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

b. Offset: Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer's Technical Representative, but shall not exceed 5 degrees.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of UBPPA UNI-B-3 for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94/C 94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts

sand, and 5 parts gravel, having the same minimum compressive strength.

d. Fittings: Install in accordance with AWWA C605.

3.1.2.3 Installation of Valves and Hydrants

a. Installation of Valves: Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, contact the Contracting Officer's Technical Representative for further instructions.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the point indicated; such water service lines shall be closed with plugs or caps.

3.1.4 Special Requirements for Installation of Water Service Piping

3.1.4.1 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

b. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4.2 Location of Meters

Meters and meter boxes shall be installed at the locations shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

3.1.5 Disinfection

Prior to disinfection, obtain Contracting Officer's Technical Representative approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer's Technical Representative approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer's Technical Representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water mains in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test PVC plastic water mains in accordance with the requirements of UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in UBPPA UNI-B-3, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of

the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 33 30 00

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASTM INTERNATIONAL (ASTM)

ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 270	(2007) Standard Specification for Mortar for Unit Masonry
ASTM C 443	(2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 923	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM C 969	(2002) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 972	(2000; R 2006) Compression-Recovery of Tape Sealant
ASTM C 990	(2006) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM D 1784	(2006a) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	(2005) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(2006) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a; R 2003e1) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 4101	(2007) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D 412	(2006a) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 624	(2000e1) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(Basic) Frames.Covers, Gratings, Steps, Sump and Catch Basin, Manhole

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27 Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6 (1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide lateral of polyvinyl chloride (PVC) plastic pipe. Provide building connections polyvinyl chloride (PVC) plastic pipe. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

1.2.2 Sanitary Sewer Pressure Lines

Provide pressure lines of polyvinyl chloride (PVC) plastic pressure pipe.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contracting Officer's Technical Representative. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer's Technical Representative. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipeline materials;

Submit manufacturer's standard drawings or catalog cuts.

SD-06 Test Reports

Reports;

Test and inspection reports, as specified.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

2.1.2.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.

(1) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478 base and first riser shall be monolithic.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923 or ASTM C 990.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Proplene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and values are listed in the following tables:

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic

Tensile, psi	ASTM D 412	1840	2195	-
Elogation percent	ASTM D 412	553	295	350
Tear Resistance, ppi	ASTM D 624 (Die B)	280	160	-
Rebound, percent, 5 minutes	ASTM C 972 (mod.)	-	-	11
Rebound, percent, 2 hours	ASTM C 972	-	-	12

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

FS A-A-60005, cast iron; figure numbers shall be as indicated:

Frames and covers shall be cast iron or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 Manhole Steps

Zinc-coated steel as indicated conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less 4 feet deep.

2.4 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 31 00 00 EARTHWORK.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 2 feet below bottom of water line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on

each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

a. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer's Technical Representative before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.2.2 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Pipe Less Than 4 Inch Diameter:

1 Solvent-weld joints shall comply with the manufacturer's instructions.

b. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94/C 94M having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Manhole Construction

Use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. At the existing sewer manhole, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.5.2 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles.

Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.6 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer's Technical Representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in

accordance with ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969.

b. Low-pressure air tests: Perform tests as follows:

1 PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Test PVC plastic pressure lines in accordance with the requirements of AWWA C605 for pressure and leakage tests, using the allowable leakage given therein.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 48/A 48M	(2003) Standard Specification for Gray Iron Castings
ASTM A 536	(1984; R 2004) Standard Specification for Ductile Iron Castings
ASTM B 26/B 26M	(2005) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C 231	(2004) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(2007a) Standard Specification for Mortar for Unit Masonry
ASTM C 443	(2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 76	(2007) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 923	(2007) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using

	Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 1751	(2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 6938	(2007a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipeline materials;

Submit manufacturer's standard drawings or catalog cuts.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76, Class III.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 3500 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.2.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.2.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure.

2.2.4 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48/A 48M, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26/B 26M, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3 MANHOLE STEPS

Zinc-coated steel as indicated conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or

minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less 4 feet deep.

2.4 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C 923.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PIPELINE MATERIALS

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5
Concrete-Lined Corrugated Steel	3
Ductile Iron Culvert	3
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be thoroughly cleaned with a wet brush and the lower portion of the bell filled with mortar as required to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in lengths that extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 8 inches apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

b. Grout: Grout shall be poured between band and pipe from the high side of band only, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be forced out by pouring, and removed.

c. Remainder of Joint: The remaining unfilled upper portion of the joint shall be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete or precast reinforced concrete complete with frames and covers or gratings; and with fixed steps where indicated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe.The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers.This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract

will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 6 inches.

3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.6.5 Determination of Density

Testing is the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained.Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 6938. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 6938 results in a wet unit weight of soil and ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.7 FIELD PAINTING

After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint Do not paint surfaces subject to abrasion.

-- End of Section --

SECTION 33 71 02.00 20

UNDERGROUND ELECTRICAL DISTRIBUTION

PART 1 GENERAL

All of the work covered by this specification section shall be performed by the prime contractor or a first tier subcontractor. A first tier subcontractor is a person or entity directly contracted by and responsible to the prime contractor.

Any substitutions of subcontractors, suppliers, manufacturer's, or personnel from those represented in the successful proposal is prohibited without the approval of the Contracting Officer's Technical Representative.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318M	(2005) Metric Building Code Requirements for Structural Concrete and Commentary
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005) Standard Specifications for Highway Bridges
AASHTO M 198	(2005) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM INTERNATIONAL (ASTM)

ASTM B 1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B 3	(2001; R 2007) Standard Specification for Soft or Annealed Copper Wire
ASTM B 8	(2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM C 478	(2007) Standard Specification for Precast Reinforced Concrete Manhole Sections

ASTM C 857	(2007) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM F 512	(2006) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; Errata 2007) National Electrical Safety Code
IEEE Std 100	(2000) The Authoritave Dictionary of IEEE Standards Terms

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2003) Acceptance Testing Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C119.1	(2006) Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA RN 1	(2005) Standard for Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
NEMA TC 6 & 8	(2003) Standard for Polyvinyl Chloride PVC Plastic Utilities Duct for Underground Installations
NEMA TC 9	(2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007) National Electrical Code - 2008 Edition

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758-A	(2004) Customer-Owned Outside Plant Telecommunications Cabling Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2006; Rev thru Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 44	(2005; Rev thru Nov 2005) Thermoset-Insulated Wires and Cables
UL 467	(2007) Standard for Grounding and Bonding Equipment
UL 486A-486B	(2003; Rev thru Aug 2006) Standard for Wire Connectors
UL 510	(2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(2004; Rev thru Aug 2007) Standard for Metallic Outlet Boxes
UL 514B	(2004; Rev thru Aug 2007) Standard for Conduit, Tubing and Cable Fittings
UL 6	(2007) Standard for Electrical Rigid Metal Conduit-Steel
UL 651	(2005; Rev thru May 2007) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 83	(2003; Rev thru Apr 2006) Standard for Thermoplastic-Insulated Wires and Cables
UL 854	(2004; Rev thru Oct 2007) Service-Entrance Cables

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Precast concrete structures;

Composite/fiberglass handholes;

1.4 NOT USED

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi.

2.1.2 Intermediate Metal Conduit

UL 1242.

2.1.2.1 Intermediate Metal Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi.

2.1.3 Plastic Conduit for Direct Burial

UL 651, Schedule 40 or Schedule 80 NEMA TC 2, EPC-40-PVC or EPC-80-PVC.

2.1.4 Plastic Duct for Concrete Encasement

NEMA TC 6 & 8 and ASTM F 512.

2.1.5 Innerduct

Provide corrugated or solid wall polyethylene (PE) or PVC innerducts with pullwire. Size as indicated.

2.1.6 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials. Inflatable bladders may be used as an option.

2.1.7 Fittings

2.1.7.1 Metal Fittings

UL 514B.

2.1.7.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.7.3 PVC Duct Fittings

NEMA TC 9.

2.1.7.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit shall be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and shall conform to UL 514A.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors shall be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site shall not be accepted. Service entrance conductors shall conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper. As an exception, do not substitute aluminum for copper if the equivalent aluminum conductor size would exceed 500 kcmil.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, shall be 600-volt, Type THWN/THHN conforming to UL 83 conforming to UL 44. Copper conductors shall be annealed copper complying with ASTM B 3 and ASTM B 8.

2.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.2.4 In Duct

Cables shall be single-conductor cable.

2.2.5 Cable Marking

Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Each cable shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations shall be properly identified. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. On three-phase, four-wire delta system, high leg shall be orange, as required by NFPA 70.

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Shall provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

b. For use with aluminum conductors: UL 486A-486B. For connecting aluminum to copper, connectors shall be the circumferentially compressed, metallurgically bonded type.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply NEMA C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as covering or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling in accordance with Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).

2.6 TAPE

2.6.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.6.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

2.7 PULL ROPE

Shall be plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.8 GROUNDING AND BONDING

2.8.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.8.2 Grounding Conductors

Stranded-bare copper conductors shall conform to ASTM B 8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors shall conform to ASTM B 1 for sizes No. 8 and smaller. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Aluminum is not acceptable.

2.9 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.10 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C 857 andASTM C 478. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

2.10.1 Precast Concrete Structures, Risers and Tops

In lieu of cast-in-place, Contractors, at their option, may provide precast concrete underground structures subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.10.1.1 General

Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures

shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.10.1.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads shall include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads shall consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load shall be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads shall include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, shall be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component shall be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

h. Design shall also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.10.1.3 Construction

Structure top, bottom, and wall shall be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment.

However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.10.1.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M 198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.10.2 Handhole Frames and Covers

Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled-steel floor plate having an approved antislip surface. Hinges shall be of stainless steel with bronze hinge pin, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and shall be for full surface application by fillet welding. Hinges shall have nonremovable pins and five knuckles. The surfaces of plates under hinges shall be true after the removal of raised antislip surface, by grinding or other approved method.

2.10.3 Composite/Fiberglass Handholes and Covers

Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758-A and RUS Bull 1751F-644.

3.2 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors shall be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit shall be PVC, Type EPC-40 from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

3.3 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.3.1 Requirements

Depths to top of the conduit shall be in accordance with NFPA 70. Run conduit in straight lines except where a change of direction is necessary. Numbers and sizes of ducts shall be as indicated. Ducts shall have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 3 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in structures.

3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.3.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.3.4 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be PVC coated and shall extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.3.5 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 1/2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.3.6 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.3.7 Conduit and Duct Without Concrete Encasement

Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in3 to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.3.7.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks.

3.3.8 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 1/2 inches, except separate light and power conduits from control, signal, and telecommunications conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring shall be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.3.8.1 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut

steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.3.8.2 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.3.8.3 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

3.4 CONDUCTORS INSTALLED IN PARALLEL

Conductors shall be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.5 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set.

3.6 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 23 00.00 20 EXCAVATION AND FILL.

3.6.1 Reconditioning of Surfaces

3.6.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.6.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.7 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.7.1 Concrete Slabs for Equipment

Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade shall have 1/2 inch chamfer.Slab shall be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.7.2 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.8 FIELD QUALITY CONTROL

3.8.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.8.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

REQUIRED FORMAT FOR IRREVOCABLE LETTER OF CREDIT
(As stated in FAR 52.228-14 and prescribed in FAR 28.204-4)

The following format shall be used by the issuing financial institution to create an ILC:

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date _____

Irrevocable Letter of Credit No. _____

Account party's name _____

Account party's address _____

For Solicitation No. _____ (*for reference only*)

To: *[U.S. Government agency]*
[U.S. Government Agency's Address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States $ _____. This Letter of Credit is payable at *[issuing financial institution's and, if any, confirming financial institution's]* office at *[issuing financial institution's address and, if any, confirming financial institution's address]* and expires with our close of business on _____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. *[This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.]* It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ *[state of confirming financial institution, if any, otherwise state of issuing financial institution]*.

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

_____
[Issuing financial institution]

REQUIRED FORMAT FOR FINANCIAL INSTITUTION TO CONFIRM AN IRREVOCABLE LETTER OF CREDIT
(As stated in FAR 28.228-14 and prescribed in FAR 28.204-4)

The following format shall be used by the financial institution to confirm an ILC:

[Confirming Financial Institution's Letterhead or Name and Address]

(Date) _____

Our Letter of Credit Advice Number _____

Beneficiary: _____ *[U.S. Government agency]*

Issuing Financial Institution: _____

Issuing Financial Institution's LC No.: _____

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by _____ *[name of issuing financial institution]* for drawings of up to United States dollars _____/U.S. $_____ and expiring with our close of business on _____ *[the expiration date],* or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. *[This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.]* It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ *[state of confirming financial institution]*.

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

_____
[Confirming financial institution]

FTC-FAC-70 (9/01)

CONSTRUCTION CONTRACTOR'S INVOICE

Contractor's Name and Address (As shown on Contract)

OFFICIAL DATE OF RECEIPT BY GOVERNMENT

For FLETC Use Only

CONTRACTOR MUST ALSO COMPLETE CERTIFICATION ON REVERSE OR PAYMENT WILL NOT BE MADE

Contract No. _____ Invoice No. _____ Invoice Date _____

Delivery Order No. _____ Work Order No. _____

Total Contract Amount _____ Through Change Order No. _____ Dated _____

Value of Work Completed _____

Total of Prior Invoices _____

Amount of this Invoice _____

Signature and Title _____
(Authorized Contractor Representative)

GOVERNMENT CERTIFICATION OF INVOICE Date _____

FROM: Contracting Officer's Technical Representative (COTR)
THRU: (1) Chief, Design-Construction Branch (FMD/D-CB)
(2) Contracting Officer (PRO/CCB)
TO: Budget and Finance Division (BFD/FIN)

CONTRACT WORK CERTIFIED COMPLETE $ _____

LESS: Retention $ _____

Previous Payments $ _____

Other (Deductions) $ _____

Liquid Damages @ $ _____ /day X _____ Days = $ _____

AMOUNT CERTIFIED FOR PAYMENT $ _____

Remarks:

Evaluated By: _____
COTR/PM (FMD)

Payment Approved By: _____
Contracting Officer (PRO/CCB)

Reviewed By _____
Chief, Design/Construction Branch (FMD)

Wage and Hour Division

Instructions For Completing Payroll Form, WH-347

- WH-347 (PDF)
  OMB Control No. 1235-0008, Expires 07/31/2024.

General: Form WH-347has been made available for the convenience of contractors and subcontractors required by their Federal or Federally-aided construction-type contracts and subcontracts to submit weekly payrolls. Properly filled out, this form will satisfy the requirements of Regulations, Parts 3 and 5 (29 C.F.R., Subtitle A), as to payrolls submitted in connection with contracts subject to the Davis-Bacon and related Acts.

While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Under the Davis-Bacon and related Acts, the contractor is required to pay not less than prevailing wage, including fringe benefits, as predetermined by the Department of Labor. The contractor's obligation to pay fringe benefits may be met either by payment of the fringe benefits to bona fide benefit plans, funds or programs or by making payments to the covered workers (laborers and mechanics) as cash in lieu of fringe benefits.

This payroll provides for the contractor to show on the face of the payroll all monies to each worker, whether as basic rates or as cash in lieu of fringe benefits, and provides for the contractor's representation in the statement of compliance on the payroll (as shown on page 2) that he/she is paying for fringe benefits required by the contract and not paid as cash in lieu of fringe benefits. Detailed instructions concerning the preparation of the payroll follow:

Contractor or Subcontractor: Fill in your firm's name and check appropriate box.

Address: Fill in your firm's address.

Payroll No.: Beginning with the number "1", list the payroll number for the submission.

For Week Ending: List the workweek ending date.

Project and Location: Self-explanatory.

Project or Contract No.: Self-explanatory.

Column 1 - Name and Individual Identifying Number of Worker: Enter each worker's full name and an individual identifying number (e.g., last four digits of worker's social security number) on each weekly payroll submitted.

Column 2 - No. of Withholding Exemptions: This column is merely inserted for the employer's convenience and is not a requirement of Regulations, Part 3 and 5.

Column 3 - Work Classifications: List classification descriptive of work actually performed by each laborer or mechanic. Consult classification and minimum wage schedule set forth in contract specifications. If additional classifications are deemed necessary, see Contracting Officer or Agency representative. An individual may be shown as having worked in more than one classification provided an accurate breakdown or hours worked in each classification is maintained and shown on the submitted payroll by use of separate entries.

Column 4 - Hours worked: List the day and date and straight time and overtime hours worked in the applicable boxes. On all contracts subject to the Contract Work Hours Standard Act, enter hours worked in excess of 40 hours a week as "overtime".

Column 5 - Total: Self-explanatory

Column 6 - Rate of Pay (Including Fringe Benefits): In the "straight time" box for each worker, list the actual hourly rate paid for straight time worked, plus cash paid in lieu of fringe benefits paid. When recording the straight time hourly rate, any cash paid in lieu of fringe benefits may be shown separately from the basic rate. For example, "$12.25/.40" would reflect a $12.25 base hourly rate plus $0.40 for fringe benefits. This is of assistance in correctly computing overtime. See "Fringe Benefits" below. When overtime is worked, show the overtime hourly rate paid plus any cash in lieu of fringe benefits paid in the "overtime" box for each worker; otherwise, you may skip this box. See "Fringe Benefits" below. Payment of not less than time and one-half the basic or regular rate paid is required for overtime under the Contract Work Hours Standard Act of 1962 if the prime contract exceeds $100,000. In addition to paying no less than the predetermined rate for the classification which an individual works, the contractor must pay amounts predetermined as fringe benefits in the wage decision made part of the contract to approved fringe benefit plans, funds or programs or shall pay as cash in lieu of fringe benefits. See "FRINGE BENEFITS" below.

Column 7 - Gross Amount Earned: Enter gross amount earned on this project. If part of a worker's weekly wage was earned on projects other than the project described on this payroll, enter in column 7 first the amount earned on the Federal or Federally assisted project and then the gross amount earned during the week on all projects, thus "$163.00/$420.00" would reflect the earnings of a worker who earned $163.00 on a Federally assisted construction project during a week in which $420.00 was earned on all work.

Column 8 - Deductions: Five columns are provided for showing deductions made. If more than five deduction are involved, use the first four columns and show the balance deductions under "Other" column; show actual total under "Total Deductions" column; and in the attachment to the payroll describe the deduction(s) contained in the "Other" column. All deductions must be in accordance with the provisions of the Copeland Act Regulations, 29 C.F.R., Part 3. If an individual worked on other jobs in addition to this project, show actual deductions from his/her weekly gross wage, and indicate that deductions are based on his gross wages.

Column 9 - Net Wages Paid for Week: Self-explanatory.

Totals - Space has been left at the bottom of the columns so that totals may be shown if the contractor so desires.

Statement Required by Regulations, Parts 3 and 5: While the "statement of compliance" need not be notarized, the statement (on page 2 of the payroll form) is subject to the penalties provided by 18 U.S.C. § 1001, namely, a fine, possible imprisonment of not more than 5 years, or both. Accordingly, the party signing this statement should have knowledge of the facts represented as true.

Items 1and 2: Space has been provided between items (1) and (2) of the statement for describing any deductions made. If all deductions made are adequately described in the "Deductions" column above, state "*See* Deductions column in this payroll." *See* "FRINGE BENEFITS" below for instructions concerning filling out paragraph 4 of the statement.

Item 4 FRINGE BENEFITS - Contractors who pay all required fringe benefits: If paying all fringe benefits to approved plans, funds, or programs in amounts not less than were determined in the applicable wage decision of the Secretary of Labor, show the basic cash hourly rate and overtime rate paid to each worker on the face of the payroll and check paragraph 4(a) of the statement on page 2 of the WH-347 payroll form to indicate the payment. Note any exceptions in section 4(c).

Contractors who pay no fringe benefits: If not paying all fringe benefits to approved plans, funds, or programs in amounts of at least those that were determined in the applicable wage decision of the Secretary of Labor, pay any remaining fringe benefit amount to each laborer and mechanic and insert in the "straight time" of the "Rate of Pay" column of the payroll an amount not less than the predetermined rate for each classification plus the amount of fringe benefits determined for each classification in the application wage decision. Inasmuch as it is not necessary to pay time and a half on cash paid in lieu of fringe benefits, the overtime rate shall be not less than the sum of the basic predetermined rate, plus the half time premium on basic or regular rate, plus the required cash in lieu of fringe benefits at the straight time rate. In addition, check paragraph 4(b) of the statement on page 2 the payroll form to indicate the payment of fringe benefits in cash directly to the workers. Note any exceptions in section 4(c).

Use of Section 4(c), Exceptions

Any contractor who is making payment to approved plans, funds, or programs in amounts less than the wage determination requires is obliged to pay the deficiency directly to the covered worker as cash in lieu of fringe benefits. Enter any exceptions to section 4(a) or 4(b) in section 4(c). Enter in the Exception column the craft, and enter in the Explanation column the hourly amount paid each worker as cash in lieu of fringe benefits and the hourly amount paid to plans, funds, or programs as fringe benefits. The contractor must pay an amount not less than the predetermined rate plus cash in lieu of fringe benefits as shown in section 4(c) to

each such individual for all hours worked (unless otherwise provided by applicable wage determination) on the Federal or Federally assisted project. Enter the rate paid and amount of cash paid in lieu of fringe benefits per hour in column 6 on the payroll. See paragraph on "Contractors who pay no fringe benefits" for computation of overtime rate.

Public Burden Statement: We estimate that it will take an average of 55 minutes to complete this collection of information, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W.,Washington, D.C. 20210.

Note: In order to view, fill out, and print PDF forms, you need Adobe® Acrobat® Reader® version 5 or later, which you may download for free at www.adobe.com/products/acrobat/readstep2.html.

U.S. Department of Labor
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. Dec. 2008

OMB No.:1235-0008
Expires: 07/31/2024

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐	ADDRESS	
PAYROLL NO.	FOR WEEK ENDING	PROJECT AND LOCATION / PROJECT OR CONTRACT NO.

(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE — HOURS WORKED EACH DAY	(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS: FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that is will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE.

U.S. Department of Labor
Wage and Hour Division

Davis-Bacon and Related Acts Weekly Certified Payroll Form

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Unless otherwise noted, the information requested is specific to the named project below.

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. January 2025
OMB No.: 1235-0008
Expires: 01/31/2028

☐ SUBMISSION OF FINAL DBRA CERTIFIED PAYROLL FORM ☐ PRIME CONTRACTOR ☐ SUBCONTRACTOR

PROJECT NAME	PROJECT NO. or CONTRACT NO.	CERTIFIED PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME
PROJECT LOCATION	**WAGE DETERMINATION NO.**	**WEEK ENDING DATE**	**PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS ADDRESS**

(1A)	(1B)	(1C)	(1D)	(1E)	(2)	(3)		(4)		(5)	(6A)	(6B)	(6C)	(7A)	(7B)	(8)				(9)
WORKER ENTRY NO.	WORKER LAST NAME	WORKER FIRST NAME	WORKER MIDDLE INITIAL	WORKER IDENTIFYING NO.	(J) JOURNEYWORKER (RA) REGISTERD APPRENTICE	LABOR CLASSIFICATION		ST = STRAIGHT TIME OT = OVERTIME	(TOP) DAYS OF WORK WEEK (BOTTOM) DATES HOURS WORKED EACH DAY	TOTAL HOURS WORKED FOR WEEK	HOURLY WAGE RATE PAID FOR ST AND OT	TOTAL FRINGE BENEFIT CREDIT	PAYMENT IN LIEU OF FRINGE BENEFITS	GROSS AMT EARNED	GROSS AMT EARNED FOR **ALL WORK**	DEDUCTIONS FOR **ALL WORK**				NET PAY TO WORKER FOR **ALL WORK**
																TAX WITH-HOLDINGS	FICA	OTHER (MUST SPECIFY, SEE INSTRUCTIONS)	TOTAL DEDUCTIONS	
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While use of Form WH-347 itself is optional, covered contractors and subcontractors performing work on Federal or federally assisted construction contracts are required by the DBRA regulations and the contract clauses to submit payroll information on a weekly basis. The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federal or federally financed construction contracts to, on a weekly basis, "furnish a statement on the wages paid each employee during the prior week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors and subcontractors to submit weekly certified payrolls to the appropriate Federal agency if the agency is a party to the contract (or, if the agency is not such a party, to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the Federal agency). Each certified payroll must be accompanied by a signed "Statement of Compliance" (e.g., page 2 of the WH-347 or another document with identical wording) indicating that the certified payrolls are accurate and complete, and that each laborer or mechanic has been paid not less than the required Davis-Bacon prevailing wage rate(s) (including any fringe benefits) for the work performed. DOL and contracting agencies receiving this information review the information to determine whether workers have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

PROJECT NAME	PROJECT NO. or CONTRACT NO.	PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME

PROJECT LOCATION	WEEK ENDING DATE	CERTIFYING OFFICIAL's NAME AND TITLE

I paid or supervised the payment of the laborers or mechanics working on the above project during the stated time period. I certify the following:

☐ The payroll information submitted with this statement is correct and complete for the above project during the above period, and the wage and fringe benefit rates paid to the workers, including credit taken for the reasonably anticipated costs of a bona fide fringe benefit plan, fund or program, are not less than the applicable wage and fringe benefits rates for the classification(s) of work actually performed, as specified in the wage determination(s) incorporated into the contract.

☐ All regular payrolls and all other basic records that the contractor is required to maintain for this payroll period are complete and accurate and will be made available upon request from the agency or the Department of Labor.

☐ The classifications reported for each laborer or mechanic are the classification(s) of work that each worker actually performed.

☐ Any workers paid as apprentices during the above period are duly registered in a bona fide apprenticeship program registered with the Office of Apprenticeship, Employment and Training Administration, United States Department of Labor ("OA"), or a State Apprenticeship Agency ("SAA") recognized by Department of Labor. I have verified the registered apprenticeship program information provided below as accurate and applicable to any apprentices identified on page 1 of this form.

APPRENTICESHIP PROGRAM NAME	REGISTERED		NAME OF LABOR CLASSIFICATION
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	

☐ Fringe benefits have been paid in cash and/or to bona fide fringe benefit plans, funds, or programs. Where the contractor is claiming an hourly credit for their contributions to or reasonably anticipated costs of a bona fide fringe benefit plan, fund, or program, provide plan information and the hourly credit claimed for each worker listed on the previous page of this form.

HOURLY CREDIT FOR FRINGE BENEFITS

If an amount is listed in (6B) on the first page of this certified payroll form, enter the hourly credit claimed under each plan name, type and number for each worker and check whether the plan is funded or unfunded.

NAME OF WORKER	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	TOTAL HOURLY CREDIT
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hrly Credit $	$

☐ All workers on the project have been paid the full weekly wages earned, and no rebates or deductions have been or will be made either directly or indirectly, other than permissible deductions as defined in 29 CFR part 3.

ADDITIONAL REMARKS

SIGNATURE OF CERTIFYING OFFICIAL	DATE	TELEPHONE NUMBER	EMAIL ADDRESS
		(___) ___-____	

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION (SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE), AS WELL AS DEBARMENT FROM FUTURE FEDERAL AND FEDERALLY-ASSISTED CONTRACTS. INFORMATION REPORTED IN CERTIFIED PAYROLLS MAY BE SUBJECT TO DISCLOSURE IN RESPONSE TO A FREEDOM OF INFORMATION ACT REQUEST.

DAILY REPORT TO INSPECTOR

CONTRACT NO.	TITLE AND LOCATION	DATE
		REPORT NO.

CONTRACTOR (Prime or Subcontractor)	NAME OF SUPERINTENDENT OR FOREMAN
WEATHER - A.M.	TEMPERATURE - A.M.
WEATHER - P.M.	TEMPERATURE - P.M.

PRIME CONTRACTOR / SUBCONTRACTOR WORKFORCE (Use additional sheets if required)				LOCATION AND DESCRIPTION OF WORK PERFORMED
NUMBER	TRADE	HOURS	EMPLOYER	

TOTAL WORK HOURS ON JOB SITE THIS DATE		WERE THERE ANY LOST TIME ACCIDENTS THIS DATE?
CUMULATIVE TOTAL OF HOURS FROM PREVIOUS REPORT		☐ YES ☐ NO
TOTAL WORK HOURS FROM START OF CONSTRUCTION		

INSPECTION AND / OR TESTING PERFORMED TODAY - - FOLLOW WITH REPORT	LOCATION AND / OR ELEMENT OF WORK	REMARKS RESULTS OF INSPECTION TESTING

SPEC.PARA. AND / OR DRAWING NO.	EQUIPMENT / MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB (Description, Sizes, Quantity)	SUBMITTAL NO. OR CERTIFICATION	DATE APPROV

DEPARTMENT OF HOMELAND SECURITY

NON-DISCLOSURE AGREEMENT

The person listed below is an individual official, employee, consultant, or subcontractor of or to the Authorized Entity listed above, intending to be legally bound, hereby consent to the terms in this Agreement in consideration of my being granted conditional access to certain information, specified below, that is owned by, produced by, or in the possession of the United States Government.

Full Name
Authorized Entity

Signer will acknowledge the category or categories of information that he or she may have access to, and the signer's willingness to comply with the standards for protection by placing his or her initials in front of the applicable category or categories.

PROTECTED CRITICAL INFRASTRUCTURE INFORMATION (PCII)	
Initials	I attest that I am familiar with, and I will comply with all requirements of the PCII program set out in the Critical Infrastructure Information Act of 2002 (CII Act) (Title II, Subtitle B, of the Homeland Security Act of 2002, Public Law 107-296, 196 Stat. 2135, 6 USC 101 et seq.), as amended, the implementing regulations thereto (6 CFR Part 29), as amended, and the applicable PCII Procedures Manual, as amended, and with any such requirements that may be officially communicated to me by the PCII Program Manager or the PCII Program Manager's designee.

SENSITIVE SECURITY INFORMATION (SSI)	
Initials	I attest that I am familiar with, and I will comply with the standards for access, dissemination, handling, and safeguarding of SSI information as cited in this Agreement and in accordance with 49 CFR Part 1520, "Protection of Sensitive Security Information," "Policies and Procedures for Safeguarding and Control of SSI," as amended, and any supplementary guidance issued by an authorized official of the Department of Homeland Security.

OTHER SENSITIVE BUT UNCLASSIFIED (SBU)	
Initials	As used in this Agreement, sensitive but unclassified information is an over-arching term that covers any information, not otherwise indicated above, which the loss of, misuse of, or unauthorized access to or modification of could adversely affect the national interest or the conduct of Federal programs, or the privacy to which individuals are entitled under Section 552a of Title 5, as amended, but which has not been specifically authorized under criteria established by an Executive Order or an Act of Congress to be kept secret in the interest of national defense or foreign policy. This includes information categorized by DHS or other government agencies as: For Official Use Only (FOUO); Official Use Only (OUO); Sensitive Homeland Security Information (SHSI); Limited Official Use (LOU); Law Enforcement Sensitive (LES); Safeguarding Information (SGI); Unclassified Controlled Nuclear Information (UCNI); and any other identifier used by other government agencies to categorize information as sensitive but unclassified. I attest that I am familiar with, and I will comply with the standards for access, dissemination, handling, and safeguarding of the information to which I am granted access as cited in this Agreement and in accordance with the guidance provided to me relative to the specific category of information.

ACKNOWLEDGEMENT
1. I hereby acknowledge that I have received a security indoctrination concerning the nature and protection of information to which I have been provided conditional access, including the procedures to be followed in ascertaining whether other persons to whom I contemplate disclosing this information have been approved for access to it, and that I understand these procedures.

2. By being granted conditional access to the information indicated above, the United States Government has placed special confidence and trust in me and I am obligated to protect this information from unauthorized disclosure, in accordance with the terms of this Agreement and the laws, regulations, and directives applicable to the specific categories of information to which I am granted access.

3. I attest that I understand my responsibilities and that I am familiar with and will comply with the standards for protecting such information that I may have access to in accordance with the terms of this Agreement and the laws, regulations, and/or directives applicable to the specific categories of information to which I am granted access. I understand that the United States Government may conduct inspections, at any time or place, for the purpose of ensuring compliance with the conditions for access, dissemination, handling and safeguarding information under this Agreement.

4. I will not disclose or release any information provided to me pursuant to this Agreement without proper authority or authorization. Should situations arise that warrant the disclosure or release of such information I will do so only under approved circumstances and in accordance with the laws, regulations, or directives applicable to the specific categories of information. I will honor and comply with any and all dissemination restrictions cited or verbally relayed to me by the proper authority.

    (a) For PCII - (1) Upon the completion of my engagement as an employee, consultant, or subcontractor under the contract, or the completion of my work on the PCII Program, whichever occurs first, I will surrender promptly to the PCII Program Manager or his designee, or to the appropriate PCII officer, PCII of any type whatsoever that is in my possession.

5. (2) If the Authorized Entity is a United States Government contractor performing services in support of the PCII Program, I will not request, obtain, maintain, or use PCII unless the PCII Program Manager or Program Manager's designee has first made in writing, with respect to the contractor, the certification as provided for in Section 29.8(c) of the implementing regulations to the CII Act, as amended.

6. (b) For SSI and SBU - I hereby agree that material which I have in my possession and containing information covered by this Agreement, will be handled and safeguarded in a manner that affords sufficient protection to prevent the unauthorized disclosure of or inadvertent access to such information, consistent with the laws, regulations, or directives applicable to the specific categories of information. I agree that I shall return all information to which I have had access or which is in my possession 1) upon demand by an authorized individual; and/or 2) upon the conclusion of my duties, association, or support to DHS; and/or 3) upon the determination that my official duties do not require further access to such information.

7. I hereby agree that I will not alter or remove markings, which indicate a category of information or require specific handling instructions, from any material I may come in contact with, in the case of SSI or SBU, unless such alteration or removal is consistent with the requirements set forth in the laws, regulations, or directives applicable to the specific category of information or, in the case of PCII, unless such alteration or removal is authorized by the PCII Program Manager or the PCII Program Manager's designee. I agree that if I use information from a sensitive document or other medium, I will carry forward any markings or other required restrictions to derivative products and will protect them in the same matter as the original.

8. I hereby agree that I shall promptly report to the appropriate official, in accordance with the guidance issued for the applicable category of information, any loss, theft, misuse, misplacement, unauthorized disclosure, or other security violation, I have knowledge of and whether or not I am personally involved. I also understand that my anonymity will be kept to the extent possible when reporting security violations.

9. If I violate the terms and conditions of this Agreement, such violation may result in the cancellation of my conditional access to the information covered by this Agreement. This may serve as a basis for denying me conditional access to other types of information, to include classified national security information.

    (a) With respect to SSI and SBU, I hereby assign to the United States Government all royalties, remunerations, and emoluments that have resulted, will result, or may result from any disclosure, publication, or revelation of the information not consistent with the terms of this Agreement.

    (b) With respect to PCII I hereby assign to the entity owning the PCII and the United States Government, all royalties, remunerations, and emoluments that have resulted, will result, or may result from any disclosure, publication, or revelation of PCII not consistent with the terms of this Agreement.

10. This Agreement is made and intended for the benefit of the United States Government and may be enforced by the United States Government or the Authorized Entity. By granting me conditional access to information in this context, the United States Government and, with respect to PCII, the Authorized Entity, may seek any remedy available to it to enforce this Agreement including, but not limited to, application for a court order prohibiting disclosure of information in breach of this Agreement. I understand that if I violate the terms and conditions of this Agreement, I could be subjected to administrative, disciplinary, civil, or criminal action, as appropriate, under the laws, regulations, or directives applicable to the category of information involved and neither the United States Government nor the Authorized Entity have waived any statutory or common law evidentiary privileges or protections that they may assert in any administrative or court proceeding to protect any sensitive information to which I have been given conditional access under the terms of this Agreement.
11. Unless and until I am released in writing by an authorized representative of the Department of Homeland Security (if permissible for the particular category of information), I understand that all conditions and obligations imposed upon me by this Agreement apply during the time that I am granted conditional access, and at all times thereafter.
12. Each provision of this Agreement is severable. If a court should find any provision of this Agreement to be unenforceable, all other provisions shall remain in full force and effect.
13. My execution of this Agreement shall not nullify or affect in any manner any other secrecy or non-disclosure Agreement which I have executed or may execute with the United States Government or any of its departments or agencies.
14. These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive Order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General or the Office of Special Counsel of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive Orders and statutory provisions are incorporated into this agreement and are controlling.
15. Signing this Agreement does not bar disclosures to Congress, the Special Counsel, the Inspector General of any agency, or any other agency component responsible for internal investigation or review of any information that relates to any violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or any other whistleblower protection. In addition, signing this agreement does not bar disclosure to an authorized official of an executive agency or the Department of Justice that are essential to reporting a substantial violation of law.
16. I represent and warrant that I have the authority to enter into this Agreement.
17. I have read this Non-Disclosure Agreement carefully. The briefing officer (e.g., Special Security Officer) has answered any questions that I had. I acknowledge that the briefing officer has made available to me any laws, regulations, or directives referenced in this document so that I may read them at this time, if I so choose. By applying my digital signature below, the briefing officer accepts that the signature is valid and meets the terms of non-repudiation.

I understand and agree to the following terms and conditions of my access to the information indicated above.

Full Name			
Government/Department/Agency/Business Address			
City	State	Zip Code	Phone
I make this Agreement in good faith, without mental reservation or purpose of evasion.			
Signature			Date

PRIVACY ACT STATEMENT

Authority: Homeland Security Act of 2002; and DHS Management Directive 11042.1, "SAFEGUARDING SENSITIVE BUT UNCLASSIFIED (FOR OFFICIAL USE ONLY) INFORMATION".

Principle Purpose: To execute an agreement between DHS and contractors (or consultants) working for, or on behalf of DHS, to protect DHS Sensitive but Unclassified Information from unauthorized disclosure.

Routine Use(s): The information collected on this form may be disclosed as generally permitted under 5 U.S.C. §552a (b) of the Privacy Act of 1974, as amended. This includes using the information as necessary and authorized by the routine uses published in "DHS/ALL-023 Personnel Security Management System of Records".

Disclosure: Providing this information is voluntary; however, failure to provide this information may prevent the individual from being granted access to DHS Sensitive but Unclassified Information.

Badge Application Addendum for Non-U.S. Citizens, Lawful Permanent Residents and Naturalized U.S. Citizens

Information provided by those completing this form may be used to conduct background checks on the applicant in accordance with FLETC Directive 71-01, Access Control. Privacy Act Statement: This information is provided in accordance with the Privacy Act of 1974 (5 USC 552a). Authority for this information is 5 USC 301, 5 USC 4101 et seq., Executive Order No. 11348, and Department of Homeland Security Delegation 7050. Disclosure of this information is voluntary. Failure to provide requested information may result in denial of access to the FLETC property.

TO BE COMPLETED BY APPLICANT

1. Applicants Full Name: _____

(Last, First, Middle)

Aliases Used (nicknames, maiden names, etc): _____

2.Country of Citizenship: _____

(List more than one if applicable)

Place of Birth: _____

(City, State and/or Country)

3. Status:

- ☐ US Citizen (Naturalized)
- ☐ Permanent Resident — Provide A# _____
- ☐ Non-Immigrant Status — Provide I-94# _____
- ☐ Employment Authorization Card Holder — Provide A# _____
- ☐ Border Crossing Card Holder — Provide Card# _____
- ☐ Other Status — Indicate: _____

4. Non-US Citizens must provide copies of documentation related to their status in the US, including employment authorization, passport and visa.

ATTACHED:

☐ Copy of Passport

if no Passport or Visa exists, insert "None" in provided space

Country of Issue: _____ Passport Number: _____ Date: _____

☐ Copy of Visa

Visa Number: _____ Visa Type: _____ Date: _____

☐ Copy of Naturalization Certificate

☐ Copy of Permanent Resident/Alien Card

☐ Copy of Employment Authorization Card

☐ Border Crossing Card

☐ Other document verifying non-immigrant status

5. I certify the information provided is true and accurate to the best of my knowledge. I acknowledge that knowingly or willingly falsifying information in the document is a violation of 18 US Code Section 1001.

Applicant's Signature: _____ Date: _____

DEPARTMENT OF HOMELAND SECURITY

FEDERAL LAW ENFORCEMENT TRAINING CENTERS
NAME-BASED CRIMINAL HISTORY RECORD INFORMATION CONSENT/INQUIRY FORM

I hereby give consent for the Federal Law Enforcement Training Centers (FLETC) to receive any State or Interstate Identification Index (III) criminal history record information pertaining to me, as authorized under state and federal law for individuals seeking employment or access with a criminal justice agency. Information provided by those completing this form may be used to conduct background checks on the applicant in accordance with FLETC Directive 71-01, Access Control.

Privacy Act Statement: This information is provided in accordance with the Privacy Act of 1974 (5 USC 522a). Authority for this information is 5 USC 301, 5 USC 4101 et seq., Executive Order No. 11348, and Department of Homeland Security Delegation 7050. Disclosure of this information is voluntary. Failure to provide requested information may result in denial of access to the FLETC property.

Name: _____ (Last, First, Middle)

Aliases Used: _____ (Nicknames, Maiden Names, etc.)

Country of Birth (e.g. USA): _____

Date of Birth: _____

SSN: _____

United States Citizen? ☐ Yes ☐ No

If answer is "No" you must contact OSPR/ Internal Security for required paperwork

Residential Address:

House Number and Street: _____

City, State, and Zip Code: _____

Driver License State: _____

Driver License Number: _____

Race/Ethnicity:

☐ American Indian or Native Alaskan
☐ American Hawaiian or Other Pacific Islander
☐ Asian
☐ Other: _____
☐ Black or African American
☐ Hispanic or Latino
☐ White

Gender:

☐ Male
☐ Female

I certify that the information provided is true and accurate to the best of my knowledge. I acknowledge that knowingly or willfully falsifying information in the document is a violation of 18 U.S. Code Section 1001.

Signature: _____

Date: _____

Telephone Number: _____

Employer Name: _____

Purpose of Visit to FLETC: _____

Destination (if applicable): _____

Requested Access Date: _____

Requested Departure Date: _____

AGENCY USE ONLY

Date Of Inquiry: _____

Time of Inquiry: _____

Operator's Initials: _____

Inquiry resulted in the following:

☐ No Results Found

☐ Results Found

If results found:

☐ State ID Number: _____

☐ FBI Number: _____

☐ Possible Active Warrant

Final Decision:

☐ Approved

☐ Denied

Declaration for Federal Employment*

Form Approved:
OMB No. 3206-0182

(*This form may also be used to assess fitness for federal contract employment)

Instructions

The information collected on this form is used to determine your acceptability for Federal and Federal contract employment and your enrollment status in the Government's Life Insurance program. You may be asked to complete this form at any time during the hiring process. Follow instructions that the agency provides. If you are selected, before you are appointed you will be asked to update your responses on this form and on other materials submitted during the application process and then to recertify that your answers are true.

All your answers must be truthful and complete. **A false statement on any part of this declaration or attached forms or sheets may be grounds for not hiring you, or for firing you after you begin work. Also, you may be punished by a fine or imprisonment (U.S. Code, title 18, section 1001).**

Either type your responses on this form or print clearly in dark ink. If you need additional space, attach letter-size sheets (8.5" X 11"). Include your name, Social Security Number, and item number on each sheet. We recommend that you keep a photocopy of your completed form for your records.

Privacy Act Statement

The Office of Personnel Management is authorized to request this information under sections 1302, 3301, 3304, 3328, and 8716 of title 5, U. S. Code. Section 1104 of title 5 allows the Office of Personnel Management to delegate personnel management functions to other Federal agencies. If necessary, and usually in conjunction with another form or forms, this form may be used in conducting an investigation to determine your suitability or your ability to hold a security clearance, and it may be disclosed to authorized officials making similar, subsequent determinations.

Your Social Security Number (SSN) is needed to keep our records accurate, because other people may have the same name and birth date. Public Law 104-134 (April 26, 1996) asks Federal agencies to use this number to help identify individuals in agency records. Giving us your SSN or any other information is voluntary. However, if you do not give us your SSN or any other information requested, we cannot process your application. Incomplete addresses and ZIP Codes may also slow processing.

ROUTINE USES: Any disclosure of this record or information in this record is in accordance with routine uses found in System Notice OPM/GOVT-1, General Personnel Records. This system allows disclosure of information to: training facilities; organizations deciding claims for retirement, insurance, unemployment, or health benefits; officials in litigation or administrative proceedings where the Government is a party; law enforcement agencies concerning a violation of law or regulation; Federal agencies for statistical reports and studies; officials of labor organizations recognized by law in connection with representation of employees; Federal agencies or other sources requesting information for Federal agencies in connection with hiring or retaining, security clearance, security or suitability investigations, classifying jobs, contracting, or issuing licenses, grants, or other benefits; public and private organizations, including news media, which grant or publicize employee recognitions and awards; the Merit Systems Protection Board, the Office of Special Counsel, the Equal Employment Opportunity Commission, the Federal Labor Relations Authority, the National Archives and Records Administration, and Congressional offices in connection with their official functions; prospective non-Federal employers concerning tenure of employment, civil service status, length of service, and the date and nature of action for separation as shown on the SF 50 (or authorized exception) of a specifically identified individual; requesting organizations or individuals concerning the home address and other relevant information on those who might have contracted an illness or been exposed to a health hazard; authorized Federal and non-Federal agencies for use in computer matching; spouses or dependent children asking whether the employee has changed from a self-and-family to a self-only health benefits enrollment; individuals working on a contract, service, grant, cooperative agreement, or job for the Federal government; non-agency members of an agency's performance or other panel; and agency-appointed representatives of employees concerning information issued to the employees about fitness-for-duty or agency-filed disability retirement procedures.

Public Burden Statement

Public burden reporting for this collection of information is estimated to vary from 5 to 30 minutes with an average of 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to the U.S. Office of Personnel Management, Reports and Forms Manager (3206-0182), Washington, DC 20415-7900. The OMB number, 3206-0182, is valid. OPM may not collect this information, and you are not required to respond, unless this number is displayed.

Declaration for Federal Employment*

Form Approved:
OMB No. 3206-0182

(*This form may also be used to assess fitness for federal contract employment)

GENERAL INFORMATION

1. **FULL NAME** (Provide your full name. If you have only initials in your name, provide them and indicate "Initial only". If you do not have a middle name, indicate "No Middle Name". If you are a "Jr.," "Sr.," etc. enter this under Suffix. First, Middle, Last, Suffix)

♦

2. SOCIAL SECURITY NUMBER	3a. PLACE OF BIRTH (Include city and state or country)
♦	♦

3b. ARE YOU A U.S. CITIZEN?	4. DATE OF BIRTH (MM / DD / YYYY)
☐ YES ☐ NO (If "NO", provide country of citizenship) ♦	♦
5. OTHER NAMES EVER USED (For example, maiden name, nickname, etc)	**6. PHONE NUMBERS** (Include area codes)
♦	Day ♦
♦	Night ♦

Selective Service Registration

If you are a male born after December 31, 1959, and are at least 18 years of age, civil service employment law (5 U.S.C. 3328) requires that you must register with the Selective Service System, unless you meet certain exemptions.

7a. Are you a male born after December 31, 1959? ☐ YES ☐ NO (If "NO", proceed to 8.)

7b. Have you registered with the Selective Service System? ☐ YES (If "YES", proceed to 8.) ☐ NO (If "NO", proceed to 7c.)

7c. If "NO," describe your reason(s) in item 16.

Military Service

8. Have you ever served in the United States military? ☐ YES (If "YES", provide information below) ☐ NO

If you answered "YES," list the branch, dates, and type of discharge for all active duty.
If your only active duty was training in the Reserves or National Guard, answer "NO."

Branch	From (MM/DD/YYYY)	To (MM/DD/YYYY)	Type of Discharge

Background Information

For all questions, provide all additional requested information under item 16 or on attached sheets. The circumstances of each event you list will be considered. However, in most cases you can still be considered for Federal jobs.

For questions 9,10, and 11, your answers should include convictions resulting from a plea of *nolo contendere* (no contest), but omit (1) traffic fines of $300 or less, (2) any violation of law committed before your 16th birthday, (3) any violation of law committed before your 18th birthday if finally decided in juvenile court or under a Youth Offender law, (4) any conviction set aside under the Federal Youth Corrections Act or similar state law, and (5) any conviction for which the record was expunged under Federal or state law .

9. During the last 7 years, have you been convicted, been imprisoned, been on probation, or been on parole? (Includes felonies, firearms or explosives violations, misdemeanors, and all other offenses.) *If "YES," use item 16 to provide the date, explanation of the violation, place of occurrence, and the name and address of the police department or court involved.* ☐ YES ☐ NO

10. Have you been convicted by a military court-martial in the past 7 years? *(If no military service, answer "NO.") If "YES," use item 16 to provide the date, explanation of the violation, place of occurrence, and the name and address of the military authority or court involved.* ☐ YES ☐ NO

11. Are you currently under charges for any violation of law? *If "YES," use item 16 to provide the date, explanation of the violation, place of occurrence, and the name and address of the police department or court involved.* ☐ YES ☐ NO

12. During the last 5 years, have you been fired from any job for any reason, did you quit after being told that you would be fired, did you leave any job by mutual agreement because of specific problems, or were you debarred from Federal employment by the Office of Personnel Management or any other Federal agency? *If "YES," use item 16 to provide the date, an explanation of the problem, reason for leaving, and the employer's name and address.* ☐ YES ☐ NO

13. Are you delinquent on any Federal debt? (Includes delinquencies arising from Federal taxes, loans, overpayment of benefits, and other debts to the U.S. Government, plus defaults of Federally guaranteed or insured loans such as student and home mortgage loans.) *If "YES," use item 16 to provide the type, length, and amount of the delinquency or default, and steps that you are taking to correct the error or repay the debt.* ☐ YES ☐ NO

Declaration for Federal Employment*

Form Approved:
OMB No. 3206-0182

(*This form may also be used to assess fitness for federal contract employment)

Additional Questions

14. Do any of your relatives work for the agency or government organization to which you are submitting this form? (Include: father, mother, husband, wife, son, daughter, brother, sister, uncle, aunt, first cousin, nephew, niece, father-in-law,mother-in-law, son-in-law, daughter-in-law, brother-in-law, sister-in-law, stepfather, stepmother, stepson, stepdaughter, stepbrother, stepsister, half brother, and half sister.) *If "YES," use item 16 to provide the relative's name,relationship, and the department, agency, or branch of the Armed Forces for which your relative works.* ☐ YES ☐ NO

15. Do you receive, or have you ever applied for, retirement pay, pension, or other retired pay based on military, Federal civilian, or District of Columbia Government service? ☐ YES ☐ NO

Continuation Space / Agency Optional Questions

16. Provide details requested in items 7 through 15 and 18c in the space below or on attached sheets. Be sure to identify attached sheets with your name, Social Security Number, and item number, and to include ZIP Codes in all addresses. If any questions are printed below, please answer as instructed *(these questions are specific to your position and your agency is authorized to ask them).*

Certifications / Additional Questions

APPLICANT: If you are applying for a position and have not yet been selected, carefully review your answers on this form and any attached sheets. When this form and all attached materials are accurate, read item 17, and complete 17a.

APPOINTEE: If you are being appointed, carefully review your answers on this form and any attached sheets, including any other application materials that your agency has attached to this form. If any information requires correction to be accurate as of the date you are signing, make changes on this form or the attachments and/or provide updated information on additional sheets, initialing and dating all changes and additions. When this form and all attached materials are accurate, read item 17, complete 17b, read 18, and answer 18a, 18b, and 18c as appropriate.

17. **I certify** that, to the best of my knowledge and belief, all of the information on and attached to this Declaration for Federal Employment, including any attached application materials, is true, correct, complete, and made in good faith **. I understand that a false or fraudulent answer to any question or item on any part of this declaration or its attachments may be grounds for not hiring me, or for firing me after I begin work, and may be punishable by fine or imprisonment. I understand** that any information I give may be investigated for purposes of determining eligibility for Federal employment as allowed by law or Presidential order. **I consent** to the release of information about my ability and fitness for Federal employment by employers, schools, law enforcement agencies, and other individuals and organizations to investigators, personnel specialists, and other authorized employees or representatives of the Federal Government. **I understand** that for financial or lending institutions, medical institutions, hospitals, health care professionals, and some other sources of information, a separate specific release may be needed, and I may be contacted for such a release at a later date.

17a. Applicant's Signature: _____ (Sign in ink) Date _____

17b. Appointee's Signature: _____ (Sign in ink) Date _____

Appointing Officer:
Enter Date of Appointment or Conversion
MM / DD / YYYY

18. **Appointee (Only respond if you have been employed by the Federal Government before):** Your elections of life insurance during previous Federal employment may affect your eligibility for life insurance during your new appointment. These questions are asked to help your personnel office make a correct determination.

18a. When did you leave your last Federal job? MM / DD / YYYY DATE:

18b. When you worked for the Federal Government the last time, did you waive Basic Life Insurance or any type of optional life insurance? ☐ YES ☐ NO ☐ DO NOT KNOW

18c. If you answered "YES" to item 18b, did you later cancel the waiver(s)? If your answer to item 18c is "NO," use item 16 to identify the type(s) of insurance for which waivers were not canceled. ☐ YES ☐ NO ☐ DO NOT KNOW

Standard Form 85P
Revised September 1995
U.S. Office of Personnel Management
5 CFR Parts 731, 732, and 736

Form approved:
OMB No. 3206-0191
NSN 7540-01-317-7372
85-1602

Questionnaire for Public Trust Positions

Follow instructions fully or we cannot process your form. Be sure to sign and date the certification statement on Page 7 and the release on Page 8. *If you have any questions,* call the office that gave you the form.

Purpose of this Form

The U.S. Government conducts background investigations and reinvestigations to establish that applicants or incumbents either employed by the Government or working for the Government under contract, are suitable for the job and/or eligible for a public trust or sensitive position. Information from this form is used primarily as the basis for this investigation. Complete this form only after a conditional offer of employment has been made.

Giving us the information we ask for is voluntary. However, we may not be able to complete your investigation, or complete it in a timely manner, if you don't give us each item of information we request. This may affect your placement or employment prospects.

Authority to Request this Information

The U.S. Government is authorized to ask for this information under Executive Orders 10450 and 10577, sections 3301 and 3302 of title 5, U.S. Code; and parts 5, 731, 732, and 736 of Title 5, Code of Federal Regulations.

Your Social Security number is needed to keep records accurate, because other people may have the same name and birth date. Executive Order 9397 also asks Federal agencies to use this number to help identify individuals in agency records.

The Investigative Process

Background investigations are conducted using your responses on this form and on your Declaration for Federal Employment (OF 306) to develop information to show whether you are reliable, trustworthy, of good conduct and character, and loyal to the United States. The information that you provide on this form is confirmed during the investigation. Your current employer must be contacted as part of the investigation, even if you have previously indicated on applications or other forms that you do not want this.

In addition to the questions on this form, inquiry also is made about a person's adherence to security requirements, honesty and integrity, vulnerability to exploitation or coercion, falsification, misrepresentation, and any other behavior, activities, or associations that tend to show the person is not reliable, trustworthy, or loyal.

Your Personal Interview

Some investigations will include an interview with you as a normal part of the investigative process. This provides you the opportunity to update, clarify, and explain information on your form more completely, which often helps to complete your investigation faster. It is important that the interview be conducted as soon as possible after you are contacted. Postponements will delay the processing of your investigation, and declining to be interviewed may result in your investigation being delayed or canceled.

You will be asked to bring identification with your picture on it, such as a valid State driver's license, to the interview. There are other documents you may be asked to bring to verify your identity as well. These include documentation of any legal name change, Social Security card, and/or birth certificate.

You may also be asked to bring documents about information you provided on the form or other matters requiring specific attention. These matters include alien registration, delinquent loans or taxes, bankruptcy, judgments, liens, or other financial obligations, agreements involving child custody or support, alimony or property settlements, arrests, convictions, probation, and/or parole.

Instructions for Completing this Form

1. Follow the instructions given to you by the person who gave you the form and any other clarifying instructions furnished by that person to assist you in completion of the form. Find out how many copies of the form you are to turn in. You must sign and date, in black ink, the original and each copy you submit.

2. Type or legibly print your answers in black ink (if your form is not legible, it will not be accepted). You may also be asked to submit your form in an approved electronic format.

3. All questions on this form must be answered. If no response is necessary or applicable, indicate this on the form (for example, enter "None" or "N/A"). If you find that you cannot report an exact date, approximate or estimate the date to the best of your ability and indicate this by marking "APPROX." or "EST."

4. Any changes that you make to this form after you sign it must be initialed and dated by you. Under certain limited circumstances, agencies may modify the form consistent with your intent.

5. You must use the State codes (abbreviations) listed on the back of this page when you fill out this form. Do not abbreviate the names of cities or foreign countries.

6. The 5-digit postal ZIP codes are needed to speed the processing of your investigation. The office that provided the form will assist you in completing the ZIP codes.

7. All telephone numbers must include area codes.

8. All dates provided on this form must be in Month/Day/Year or Month/Year format. Use numbers (1-12) to indicate months. For example, June 10, 1978, should be shown as 6/10/78.

9. Whenever "City (Country)" is shown in an address block, also provide in that block the name of the country when the address is outside the United States.

10. If you need additional space to list your residences or employments/self-employments/unemployments or education, you should use a continuation sheet, SF 86A. If additional space is needed to answer other items, use a blank piece of paper. Each blank piece of paper you use must contain **your name and Social Security Number at the top of the page.**

Final Determination on Your Eligibility

Final determination on your eligibility for a public trust or sensitive position and your being granted a security clearance is the responsibility of the Office of Personnel Management or the Federal agency that requested your investigation. You may be provided the opportunity personally to explain, refute, or clarify any information before a final decision is made.

Penalties for Inaccurate or False Statements

The U.S. Criminal Code (title 18, section 1001) provides that knowingly falsifying or concealing a material fact is a felony which may result in fines of up to $10,000, and/or 5 years imprisonment, or both. In addition, Federal agencies generally fire, do not grant a security clearance, or disqualify individuals who have materially and deliberately falsified these forms, and this remains a part of the permanent record for future placements. Because the position for which you are being considered is one of public trust or is sensitive, your trustworthiness is a very important consideration in deciding your suitability for placement or retention in the position.

Your prospects of placement are better if you answer all questions truthfully and completely. You will have adequate opportunity to explain any information you give us on the form and to make your comments part of the record.

Disclosure of Information

The information you give us is for the purpose of investigating you for a position; we will protect it from unauthorized disclosure. The collection, maintenance, and disclosure of background investigative information is governed by the Privacy Act. The agency which requested the investigation and the agency which conducted the investigation have published notices in the Federal Register describing the system of records in which your records will be maintained. You may obtain copies of the relevant notices from the person who gave you this form. The information on this form, and information we collect during an investigation may be disclosed without your consent as permitted by the Privacy Act (5 USC 552a(b)) and as follows:

PRIVACY ACT ROUTINE USES

1. To the Department of Justice when: (a) the agency or any component thereof; or (b) any employee of the agency in his or her official capacity; or (c) any employee of the agency in his or her individual capacity where the Department of Justice has agreed to represent the employee; or (d) the United States Government, is a party to litigation or has interest in such litigation, and by careful review, the agency determines that the records are both relevant and necessary to the litigation and the use of such records by the Department of Justice is therefore deemed by the agency to be for a purpose that is compatible with the purpose for which the agency collected the records.

2. To a court or adjudicative body in a proceeding when: (a) the agency or any component thereof; or (b) any employee of the agency in his or her official capacity; or (c) any employee of the agency in his or her individual capacity where the Department of Justice has agreed to represent the employee; or (d) the United States Government is a party to litigation or has interest in such litigation, and by careful review, the agency determines that the records are both relevant and necessary to the litigation and the use of such records is therefore deemed by the agency to be for a purpose that is compatible with the purpose for which the agency collected the records.

3. Except as noted in Question 21, when a record on its face, or in conjunction with other records, indicates a violation or potential violation of law, whether civil, criminal, or regulatory in nature, and whether arising by general statute, particular program statute, regulation, rule, or order issued pursuant thereto, the relevant records may be disclosed to the appropriate Federal, foreign, State, local, tribal, or other public authority responsible for enforcing, investigating or prosecuting such violation or charged with enforcing or implementing the statute, rule, regulation, or order.

4. To any source or potential source from which information is requested in the course of an investigation concerning the hiring or retention of an employee or other personnel action, or the issuing or retention of a security clearance, contract, grant, license, or other benefit, to the extent necessary to identify the individual, inform the source of the nature and purpose of the investigation, and to identify the type of information requested.

5. To a Federal, State, local, foreign, tribal, or other public authority the fact that this system of records contains information relevant to the retention of an employee, or the retention of a security clearance, contract, license, grant, or other benefit. The other agency or licensing organization may then make a request supported by written consent of the individual for the entire record if it so chooses. No disclosure will be made unless the information has been determined to be sufficiently reliable to support a referral to another office within the agency or to another Federal agency for criminal, civil, administrative, personnel, or regulatory action.

6. To contractors, grantees, experts, consultants, or volunteers when necessary to perform a function or service related to this record for which they have been engaged. Such recipients shall be required to comply with the Privacy Act of 1974, as amended.

7. To the news media or the general public, factual information the disclosure of which would be in the public interest and which would not constitute an unwarranted invasion of personal privacy.

8. To a Federal, State, or local agency, or other appropriate entities or individuals, or through established liaison channels to selected foreign governments, in order to enable an intelligence agency to carry out its responsibilities under the National Security Act of 1947 as amended, the CIA Act of 1949 as amended, Executive Order 12333 or any successor order, applicable national security directives, or classified implementing procedures approved by the Attorney General and promulgated pursuant to such statutes, orders or directives.

9. To a Member of Congress or to a Congressional staff member in response to an inquiry of the Congressional office made at the written request of the constituent about whom the record is maintained.

10. To the National Archives and Records Administration for records management inspections conducted under 44 USC 2904 and 2906.

11. To the Office of Management and Budget when necessary to the review of private relief legislation.

STATE CODES (ABBREVIATIONS)

Alabama	AL	Hawaii	HI	Massachusetts	MA	New Mexico	NM	South Dakota	SD
Alaska	AK	Idaho	ID	Michigan	MI	New York	NY	Tennessee	TN
Arizona	AZ	Illinois	IL	Minnesota	MN	North Carolina	NC	Texas	TX
Arkansas	AR	Indiana	IN	Mississippi	MS	North Dakota	ND	Utah	UT
California	CA	Iowa	IA	Missouri	MO	Ohio	OH	Vermont	VT
Colorado	CO	Kansas	KS	Montana	MT	Oklahoma	OK	Virginia	VA
Connecticut	CT	Kentucky	KY	Nebraska	NE	Oregon	OR	Washington	WA
Delaware	DE	Louisiana	LA	Nevada	NV	Pennsylvania	PA	West Virginia	WV
Florida	FL	Maine	ME	New Hampshire	NH	Rhode Island	RI	Wisconsin	WI
Georgia	GA	Maryland	MD	New Jersey	NJ	South Carolina	SC	Wyoming	WY
American Samoa	AS	District of Columbia	DC	Guam	GU	Northern Marianas	CM	Puerto Rico	PR
Trust Territory	TT	Virgin Islands	VI						

PUBLIC BURDEN INFORMATION

Public burden reporting for this collection of information is estimated to average 60 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Reports and Forms Management Officer, U.S. Office of Personnel Management, 1900 E Street, N.W., Room CHP-500, Washington, D.C. 20415. Do not send your completed form to this address.

Standard Form 85P (EG)
Revised September 1995
U.S. Office of Personnel Management
5 CFR Parts 731, 732, and 736

QUESTIONNAIRE FOR PUBLIC TRUST POSITIONS

Form approved:
OMB No. 3206-0191
NSN 7540-01-317-7372
85-1602

OPM USE ONLY | Codes | Case Number

Agency Use Only *(Complete items A through P using instructions provided by USOPM)*

A Type of Investigation	B Extra Coverage	C Sensitivity/ Risk Level	D Compu/ ADP	E Nature of Action Code	F Date of Action (Month / Day / Year)

G Geographic Location	H Position Code	I Position Title

J SON	K Location of Official Personnel Folder	Other Address	ZIP Code
	☐ None ☐ NPRC ☐ At SON		

L SOI	M Location of Security Folder	Other Address	ZIP Code
	☐ None ☐ At SOI ☐ NPI		

N OPAC-ALC Number	O Accounting Data and/or Agency Case Number

P Requesting Official	Name and Title	Signature	Telephone Number ( )	Date

Persons completing this form should begin with the questions below.

1 FULL NAME • If you have only initials in your name, use them and state (IO). • If you have no middle name, enter "NMN". - If you are a "Jr.," "Sr.," "II," etc., enter this in the box after your middle name.

2 DATE OF BIRTH

Last Name	First Name	Middle Name	Jr., II, etc.	Month	Day	Year

3 PLACE OF BIRTH - Use the two letter code for the State.

City	County	State	Country *(if not in the United States)*

4 SOCIAL SECURITY NUMBER

5 OTHER NAMES USED

Name	Month/Year To Month/Year	Name	Month/Year To Month/Year
#1		#3	
#2		#4	

6 OTHER IDENTIFYING INFORMATION

Height *(feet and inches)*	Weight *(pounds)*	Hair Color	Eye Color	Sex *(Mark one box)*
				☐ Female ☐ Male

7 TELEPHONE NUMBERS

Work *(include Area Code and extension)*	Home *(include Area Code)*
☐ Day ☐ Night ( )	☐ Day ☐ Night ( )

8 CITIZENSHIP

a Mark the box at the right that reflects your current citizenship status, and follow its instructions.

- ☐ I am a U.S. citizen or national by birth in the U.S. or U.S. territory/possession. *Answer items b and d.*
- ☐ I am a U.S. citizen, but I was NOT born in the U.S. *Answer items b, c and d.*
- ☐ I am not a U.S. citizen. *Answer items b and e.*

b Your Mother's Maiden Name

c UNITED STATES CITIZENSHIP If you are a U.S. Citizen, but were not born in the U.S., provide information about one or more of the following proofs of your citizenship.

Naturalization Certificate *(Where were you naturalized?)*

Court	City	State	Certificate Number	Month/Day/Year Issued

Citizenship Certificate *(Where was the certificate issued?)*

City	State	Certificate Number	Month/Day/Year Issued

State Department Form 240 - Report of Birth Abroad of a Citizen of the United States

Give the date the form was prepared and give an explanation if needed.	Month/Day/Year	Explanation

U.S. Passport

This may be either a current or previous U.S. Passport	Passport Number	Month/Day/Year Issued

d DUAL CITIZENSHIP If you are *(or were)* a dual citizen of the United States and another country, provide the name of that country in the space to the right. Country

e ALIEN If you are an alien, provide the following information:

	City	State	Date You Entered U.S. Month	Day	Year	Alien Registration Number	Country(ies) of Citizenship
Place You Entered the United States:							

9 WHERE YOU HAVE LIVED

List the places where you have lived, beginning with the most recent (#1) and working back 7 years. All periods must be accounted for in your list. Be sure to indicate the actual physical location of your residence: do not use a post office box as an address, do not list a permanent address when you were actually living at a school address, etc. Be sure to specify your location as closely as possible: for example, do not list only your base or ship, list your barracks number or home port. You may omit temporary military duty locations under 90 days (list your permanent address instead), and you should use your APO/FPO address if you lived overseas.

For any address in the last 5 years, list a person who knew you at that address, and who preferably still lives in that area (do not list people for residences completely outside this 5-year period, and do not list your spouse, former spouses, or other relatives). Also for addresses in the last 5 years, if the address is "General Delivery," a Rural or Star Route, or may be difficult to locate, provide directions for locating the residence on an attached continuation sheet.

#1	Month/Year To Present	Month/Year	Street Address	Apt. #	City (Country)		State	ZIP Code
Name of Person Who Knows You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )	
#2	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)		State	ZIP Code
Name of Person Who Knew You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )	
#3	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)		State	ZIP Code
Name of Person Who Knew You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )	
#4	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)		State	ZIP Code
Name of Person Who Knew You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )	
#5	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)		State	ZIP Code
Name of Person Who Knew You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )	

10 WHERE YOU WENT TO SCHOOL

List the schools you have attended, beyond Junior High School, **beginning with the most recent (#1) and working back 7 years.** List **all** College or University degrees and the dates they were received. If all of your education occurred more than 7 years ago, list your most recent education beyond high school, no matter when that education occurred.

- Use one of the following codes in the "Code" block:

  1 - High School **2** - College/University/Military College **3** - Vocational/Technical/Trade School

- For schools you attended in the past 3 years, list a person who knew you at school (an instructor, student, etc.). Do not list people for education completely outside this 3-year period.

- For correspondence schools and extension classes, provide the address where the records are maintained.

#1	Month/Year To	Month/Year	Code	Name of School	Degree/Diploma/Other		Month/Year Awarded
Street Address and City (Country) of School						State	ZIP Code
Name of Person Who Knew You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )
#2	Month/Year To	Month/Year	Code	Name of School	Degree/Diploma/Other		Month/Year Awarded
Street Address and City (Country) of School						State	ZIP Code
Name of Person Who Knew You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )
#3	Month/Year To	Month/Year	Code	Name of School	Degree/Diploma/Other		Month/Year Awarded
Street Address and City (Country) of School						State	ZIP Code
Name of Person Who Knew You		Street Address	Apt. #	City (Country)	State	ZIP Code	Telephone Number ( )

Enter your Social Security Number before going to the next page →

11 YOUR EMPLOYMENT ACTIVITIES

List your employment activities, beginning with the present (#1) and working back 7 years. You should list all full-time work, part-time work, military service, temporary military duty locations over 90 days, self-employment, other paid work, and all periods of unemployment. The entire 7-year period must be accounted for without breaks, but you need not list employments before your 16th birthday.

- **Code.** Use one of the codes listed below to identify the type of employment:
  - **1** - Active military duty stations
  - **2** - National Guard/Reserve
  - **3** - U.S.P.H.S. Commissioned Corps
  - **4** - Other Federal employment
  - **5** - State Government (Non-Federal employment)
  - **6** - Self-employment (Include business and/or name of person who can verify)
  - **7** - Unemployment (Include name of person who can verify)
  - **8** - Federal Contractor (List Contractor, not Federal agency)
  - **9** - Other

- **Employer/Verifier Name.** List the business name of your employer or the name of the person who can verify your self-employment or unemployment in this block. If military service is being listed, include your duty location or home port here as well as your branch of service. You should provide separate listings to reflect changes in your military duty locations or home ports.

- **Previous Periods of Activity.** Complete these lines if you worked for an employer on more than one occasion at the same location. After entering the most recent period of employment in the initial numbered block, provide previous periods of employment at the same location on the additional lines provided. For example, if you worked at XY Plumbing in Denver, CO, during 3 separate periods of time, you would enter dates and information concerning the most recent period of employment first, and provide dates, position titles, and supervisors for the two previous periods of employment on the lines below that information.

Month/Year Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank
#1 To Present			

Employer's/Verifier's Street Address	City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)	City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)	City (Country)	State	ZIP Code	Telephone Number ( )

	Month/Year Month/Year	Position Title	Supervisor
PREVIOUS PERIODS OF ACTIVITY *(Block #1)*	To		
	Month/Year Month/Year To	Position Title	Supervisor
	Month/Year Month/Year To	Position Title	Supervisor

Month/Year Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank
#2 To			

Employer's/Verifier's Street Address	City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)	City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)	City (Country)	State	ZIP Code	Telephone Number ( )

	Month/Year Month/Year	Position Title	Supervisor
PREVIOUS PERIODS OF ACTIVITY *(Block #2)*	To		
	Month/Year Month/Year To	Position Title	Supervisor
	Month/Year Month/Year To	Position Title	Supervisor

Month/Year Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank
#3 To			

Employer's/Verifier's Street Address	City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)	City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)	City (Country)	State	ZIP Code	Telephone Number ( )

	Month/Year Month/Year	Position Title	Supervisor
PREVIOUS PERIODS OF ACTIVITY *(Block #3)*	To		
	Month/Year Month/Year To	Position Title	Supervisor
	Month/Year Month/Year To	Position Title	Supervisor

Enter your Social Security Number before going to the next page →

YOUR EMPLOYMENT ACTIVITIES *(CONTINUED)*

Month/Year	Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank
#4	To			

Employer's/Verifier's Street Address	City (Country)	State	ZIP Code	Telephone Number
				( )
Street Address of Job Location (if different than Employer's Address)	City (Country)	State	ZIP Code	Telephone Number
				( )
Supervisor's Name & Street Address (if different than Job Location)	City (Country)	State	ZIP Code	Telephone Number
				( )

PREVIOUS PERIODS OF ACTIVITY *(Block #4)*	Month/Year	Month/Year	Position Title	Supervisor
		To		
	Month/Year	Month/Year	Position Title	Supervisor
		To		
	Month/Year	Month/Year	Position Title	Supervisor
		To		

Month/Year	Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank
#5	To			

Employer's/Verifier's Street Address	City (Country)	State	ZIP Code	Telephone Number
				( )
Street Address of Job Location (if different than Employer's Address)	City (Country)	State	ZIP Code	Telephone Number
				( )
Supervisor's Name & Street Address (if different than Job Location)	City (Country)	State	ZIP Code	Telephone Number
				( )

PREVIOUS PERIODS OF ACTIVITY *(Block #5)*	Month/Year	Month/Year	Position Title	Supervisor
		To		
	Month/Year	Month/Year	Position Title	Supervisor
		To		
	Month/Year	Month/Year	Position Title	Supervisor
		To		

Month/Year	Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank
#6	To			

Employer's/Verifier's Street Address	City (Country)	State	ZIP Code	Telephone Number
				( )
Street Address of Job Location (if different than Employer's Address)	City (Country)	State	ZIP Code	Telephone Number
				( )
Supervisor's Name & Street Address (if different than Job Location)	City (Country)	State	ZIP Code	Telephone Number
				( )

PREVIOUS PERIODS OF ACTIVITY *(Block #6)*	Month/Year	Month/Year	Position Title	Supervisor
		To		
	Month/Year	Month/Year	Position Title	Supervisor
		To		
	Month/Year	Month/Year	Position Title	Supervisor
		To		

12 **YOUR EMPLOYMENT RECORD**

Has any of the following happened to you in the last 7 years? If "Yes," begin with the most recent occurrence and go backward, providing date fired, quit, or left, and other information requested.	Yes	No

Use the following codes and explain the reason your employment was ended:

1 - Fired from a job

2 - Quit a job after being told you'd be fired

3 - Left a job by mutual agreement following allegations of misconduct

4 - Left a job by mutual agreement following allegations of unsatisfactory performance

5 - Left a job for other reasons under unfavorable circumstances

Month/Year	Code	Specify Reason	Employer's Name and Address *(Include city/Country if outside U.S.)*	State	ZIP Code

Enter your Social Security Number before going to the next page →

13 PEOPLE WHO KNOW YOU WELL

List three people who know you well and live in the United States. They should be good friends, peers, colleagues, college roommates, etc., whose combined association with you covers as well as possible the last 7 years. Do not list your spouse, former spouses, or other relatives, and try not to list anyone who is listed elsewhere on this form.

Name	Dates Known Month/Year To Month/Year	Telephone Number Day / Night ( )
#1		
Home or Work Address	City (Country)	State / ZIP Code
Name	Dates Known Month/Year To Month/Year	Telephone Number Day / Night ( )
#2		
Home or Work Address	City (Country)	State / ZIP Code
Name	Dates Known Month/Year To Month/Year	Telephone Number Day / Night ( )
#3		
Home or Work Address	City (Country)	State / ZIP Code

14 YOUR MARITAL STATUS

Mark one of the following boxes to show your current marital status:

- ☐ **1** - Never married *(go to question 15)*
- ☐ **2** - Married
- ☐ **3** - Separated
- ☐ **4** - Legally Separated
- ☐ **5** - Divorced
- ☐ **6** - Widowed

Current Spouse Complete the following about your current spouse.

Full Name	Date of Birth *(Mo./Day/Yr.)*	Place of Birth *(Include country if outside the U.S.)*	Social Security Number

Other Names Used *(Specify maiden name, names by other marriages, etc., and show dates used for each name)*

Country of Citizenship	Date Married *(Mo./Day/Yr.)*	Place Married *(Include country if outside the U.S.)*	State
If Separated, Date of Separation *(Mo./Day/Yr.)*	If Legally Separated, Where is the Record Located? City *(Country)*		State

Address of Current Spouse *(Street, city, and country if outside the U.S.)*	State	ZIP Code

15 YOUR RELATIVES

Give the full name, correct code, and other requested information for each of your relatives, living or dead, specified below.

1 - Mother *(first)* **2** - Father *(second)* **3** - Stepmother **4** - Stepfather **5** - Foster Parent **6** - Child *(adopted also)* **7** - Stepchild

	Full Name *(If deceased, check box on the left before entering name)*	Code	Date of Birth Month/Day/Year	Country of Birth	Country(ies) of Citizenship	Current Street Address and City *(country)* of Living Relatives	State
☐		1					
☐		2					
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							

Enter your Social Security Number before going to the next page →

16 YOUR MILITARY HISTORY

	Yes	No
a Have you served in the United States military?		
b Have you served in the United States Merchant Marine?		

List all of your military service below, including service in Reserve, National Guard, and U.S. Merchant Marine. Start with the most recent period of service (#1) and work backward. If you had a break in service, each separate period should be listed.

- **Code.** Use one of the codes listed below to identify your branch of service:

1 - Air Force **2** - Army **3** - Navy **4** - Marine Corps **5** - Coast Guard **6** - Merchant Marine **7** - National Guard

- **O/E.** Mark "O" block for Officer or "E" block for Enlisted.

- **Status.** "X" the appropriate block for the status of your service during the time that you served. If your service was in the National Guard, do not use an "X"; use the two-letter code for the state to mark the block.

- **Country.** If your service was with other than the U.S. Armed Forces, identify the country for which you served.

Month/Year To Month/Year	Code	Service/Certificate No.	O	E	Status: Active	Status: Active Reserve	Status: Inactive Reserve	Status: National Guard (State)	Country
To									
To									

17 YOUR SELECTIVE SERVICE RECORD

	Yes	No
a Are you a male born after December 31, 1959? If "**No**," go to **18**. If "**Yes**," go to b.		
b Have you registered with the Selective Service System? If "Yes," provide your registration number. If "**No**," show the reason for your legal exemption below.		

Registration Number | Legal Exemption Explanation

18 YOUR INVESTIGATIONS RECORD

	Yes	No
a Has the United States Government ever investigated your background and/or granted you a security clearance? If "**Yes**," use the codes that follow to provide the requested information below. If "**Yes**," but you can't recall the investigating agency and/or the security clearance received, enter "**Other**" agency code or clearance code, as appropriate, and "**Don't know**" or "**Don't recall**" under the "**Other Agency**" heading, below. If your response is "**No**," or you don't know or can't recall if you were investigated and cleared, check the "**No**" box.		

Codes for Investigating Agency
1 - Defense Department **2** - State Department **3** - Office of Personnel Management **4** - FBI **5** - Treasury Department **6** - Other *(Specify)*

Codes for Security Clearance Received
0 - Not Required **1** - Confidential **2** - Secret **3** - Top Secret **4** - Sensitive Compartmented Information **5** - Q **6** - L **7** - Other

Month/Year	Agency Code	Other Agency	Clearance Code	Month/Year	Agency Code	Other Agency	Clearance Code

	Yes	No
b To your knowledge, have you ever had a clearance or access authorization denied, suspended, or revoked, or have you ever been debarred from government employment? If "**Yes**," give date of action and agency. **Note:** An administrative downgrade or termination of a security clearance is not a revocation.		

Month/Year	Department or Agency Taking Action	Month/Year	Department or Agency Taking Action

19 FOREIGN COUNTRIES YOU HAVE VISITED

List foreign countries you have visited, except on travel under official Government orders, beginning with the most current (#1) and working back 7 years. (Travel as a dependent or contractor must be listed.)

- Use one of these codes to indicate the purpose of your visit: **1** - Business **2** - Pleasure **3** - Education **4** - Other

- Include short trips to Canada or Mexico. If you have lived near a border and have made short (one day or less) trips to the neighboring country, you do not need to list each trip. Instead, provide the time period, the code, the country, and a note ("Many Short Trips").

- Do not repeat travel covered in items 9, 10, or 11.

	Month/Year To Month/Year	Code	Country		Month/Year To Month/Year	Code	Country
#1	To			#5	To		
#2	To			#6	To		
#3	To			#7	To		
#4	To			#8	To		

Enter your Social Security Number before going to the next page →

20 YOUR POLICE RECORD *(Do not include anything that happened before your 16th birthday.)*

Yes	No

In the last 7 years, have you been arrested for, charged with, or convicted of any offense(s)? (Leave out traffic fines of less than $150.)

If you answered "Yes," explain your answer(s) in the space provided.

Month/Year	Offense	Action Taken	Law Enforcement Authority or Court *(City and county/country if outside the U.S.)*	State	ZIP Code

21 ILLEGAL DRUGS

Yes	No

The following questions pertain to the illegal use of drugs or drug activity. You are required to answer the questions fully and truthfully, and your failure to do so could be grounds for an adverse employment decision or action against you, but neither your truthful responses nor information derived from your responses will be used as evidence against you in any subsequent criminal proceeding.

a In the last year, have you illegally used any controlled substance, for example, marijuana, cocaine, crack cocaine, hashish, narcotics (opium, morphine, codeine, heroin, etc.), amphetamines, depressants (barbiturates, methaqualone, tranquilizers, etc.), hallucinogenics (LSD, PCP, etc.), or prescription drugs?

b In the last 7 years, have you been involved in the illegal purchase, manufacture, trafficking, production, transfer, shipping, receiving, or sale of any narcotic, depressant, stimulant, hallucinogen, or cannabis, for your own intended profit or that of another?

If you answered "Yes" to "a" above, provide information relating to the types of substance(s), the nature of the activity, and any other details relating to your involvement with illegal drugs. Include any treatment or counseling received.

Month/Year	Month/Year	Controlled Substance/Prescription Drug Used	Number of Times Used
	To		
	To		
	To		

22 YOUR FINANCIAL RECORD

Yes	No

a In the last 7 years, have you, or a company over which you exercised some control, filed for bankruptcy, been declared bankrupt, been subject to a tax lien, or had legal judgment rendered against you for a debt? If you answered "Yes," provide date of initial action and other information requested below.

Month/Year	Type of Action	Name Action Occurred Under	Name/Address of Court or Agency Handling Case	State	ZIP Code

b Are you now over 180 days delinquent on any loan or financial obligation? Include loans or obligations funded or guaranteed by the Federal Government.

Yes	No

If you answered "**Yes**," provide the information requested below:

Month/Year	Type of Loan or Obligation and Account #	Name/Address of Creditor or Obligee	State	ZIP Code

After completing this form and any attachments, you should review your answers to all questions to make sure the form is complete and accurate, and then sign and date the following certification and sign and date the release on Page 8.

Certification That My Answers Are True

My statements on this form, and any attachments to it, are true, complete, and correct to the best of my knowledge and belief and are made in good faith. I understand that a knowing and willful false statement on this form can be punished by fine or imprisonment or both. (See section 1001 of title 18, United States Code).

Signature *(Sign in ink)* | Date

Enter your Social Security Number before going to the next page →

Standard Form 85P
Revised September 1995
U.S. Office of Personnel Management
5 CFR Parts 731, 732, and 736

Form approved:
OMB No. 3206-0191
NSN 7540-01-317-7372
85-1602

UNITED STATES OF AMERICA

AUTHORIZATION FOR RELEASE OF INFORMATION

Carefully read this authorization to release information about you, then sign and date it in ink.

I Authorize any investigator, special agent, or other duly accredited representative of the authorized Federal agency conducting my background investigation, to obtain any information relating to my activities from individuals, schools, residential management agents, employers, criminal justice agencies, credit bureaus, consumer reporting agencies, collection agencies, retail business establishments, or other sources of information. This information may include, but is not limited to, my academic, residential, achievement, performance, attendance, disciplinary, employment history, criminal history record information, and financial and credit information. I authorize the Federal agency conducting my investigation to disclose the record of my background investigation to the requesting agency for the purpose of making a determination of suitability or eligibility for a security clearance.

I Understand that, for financial or lending institutions, medical institutions, hospitals, health care professionals, and other sources of information, a separate specific release will be needed, and I may be contacted for such a release at a later date. Where a separate release is requested for information relating to mental health treatment or counseling, the release will contain a list of the specific questions, relevant to the job description, which the doctor or therapist will be asked.

I Further Authorize any investigator, special agent, or other duly accredited representative of the U.S. Office of Personnel Management, the Federal Bureau of Investigation, the Department of Defense, the Defense Investigative Service, and any other authorized Federal agency, to request criminal record information about me from criminal justice agencies for the purpose of determining my eligibility for assignment to, or retention in a sensitive National Security position, in accordance with 5 U.S.C. 9101. I understand that I may request a copy of such records as may be available to me under the law.

I Authorize custodians of records and other sources of information pertaining to me to release such information upon request of the investigator, special agent, or other duly accredited representative of any Federal agency authorized above regardless of any previous agreement to the contrary.

I Understand that the information released by records custodians and sources of information is for official use by the Federal Government only for the purposes provided in this Standard Form 85P, and that it may be redisclosed by the Government only as authorized by law.

Copies of this authorization that show my signature are as valid as the original release signed by me. This authorization is valid for five (5) years from the date signed or upon the termination of my affiliation with the Federal Government, whichever is sooner.

Signature *(Sign in ink)*	Full Name *(Type or Print Legibly)*		Date Signed
Other Names Used			Social Security Number
Current Address *(Street, City)*	State	ZIP Code	Home Telephone Number *(Include Area Code)*
			( )

Standard Form 85P
Revised September 1995
U.S. Office of Personnel Management
5 CFR Parts 731, 732, and 736

Form approved:
OMB No. 3206-0191
NSN 7540-01-317-7372
85-1602

UNITED STATES OF AMERICA

AUTHORIZATION FOR RELEASE OF MEDICAL INFORMATION

Carefully read this authorization to release information about you, then sign and date it in black ink.

Instructions for Completing this Release

This is a release for the investigator to ask your health practitioner(s) the three questions below concerning your mental health consultations. Your signature will allow the practitioner(s) to answer only these questions.

I am seeking assignment to or retention in a position of public trust with the Federal Government as a(n)

_____

(Investigator instructed to write in position title.)

As part of the investigative process, **I hereby authorize** the investigator, special agent, or duly accredited representative of the authorized Federal agency conducting my background investigation, to obtain the following information relating to my mental health consultations:

Does the person under investigation have a condition or treatment that could impair his/her judgment or reliability?

If so, please describe the nature of the condition and the extent and duration of the impairment or treatment.

What is the prognosis?

I understand that the information released pursuant to this release is for use by the Federal Government only for purposes provided in the Standard Form 85P and that it may be redisclosed by the Government only as authorized by law.

Copies of this authorization that show my signature are as valid as the original release signed by me. This authorization is valid for 1 year from the date signed or upon termination of my affiliation with the Federal Government, whichever is sooner.

Signature *(Sign in ink)*	Full Name *(Type or Print Legibly)*		Date Signed
Other Names Used			Social Security Number
Current Address *(Street, City)*	State	ZIP Code	Home Telephone Number *(Include Area Code)*
			( )

Contractor Specific Regulations Handout

This exhibit outlines security requirements of Contractor Personnel granted access of any type or duration to the Federal Law Enforcement Training Center (FLETC) to ensure effective and continual security and safety at all FLETC facilities. These requirements apply to all persons entering, transiting, working upon, or departing FLETC facilities (i.e., FLETC/Glynco, GA; FLETC/Artesia, NM; FLETC/Charleston, SC; and FLETC/Cheltenham, MD) for any reason; and any other applicable properties or facilities owned, leased, or otherwise controlled or administered by the FLETC.

The security procedures described herein contains security elements including, but not limited to, Physical Security, Personnel Security, Operations Security, and Administrative Security under the authority of the FLETC Office of Security and Emergency Management (SEM). Adherence to this layered security approach is mandatory and is for the protection of all persons, property, and sensitive information. All references to FLETC manuals, directives, or higher headquarters instructions are intended as the most current versions.

These security elements apply to all Contractor Personnel who access any FLETC facility or location for whatever reason. The term "Contractor Personnel" means all contractors, subcontractors, their employees and representatives.

BUILDING/AREA SECURITY AND ACCESS

DEFINITIONS:

A. **FLETC Facility** is defined as any training site under the administrative and operational control of the FLETC.

RESPONSIBILITIES: It is the responsibility of the FLETC to provide effective building/area security and access control for all personnel and property.

A. **Contractor Supervisors/Managers.** All Contractor supervisors/managers will ensure that subordinate personnel and staff adhere to the requirements of this manual, as applicable. These personnel are responsible for:

- Ensuring that senior and supervisory level ownership of building/area security and access is established and maintained.

- Ensuring controlled access to their respective assigned buildings and areas.

- Maintaining close control and accountability over the keys and combinations assigned to them for building/area security and access.

- Coordinating any requests for additional security services involving building/area access control, to include issues having enterprise-wide ramifications, through the COR.

- Providing effective emergency access by ensuring the site-specific Lock and Key Control Officer is provided with duplicate keys to all applicable

locks.

- Ensuring areas required for classified national security information, weapons, ammunition, explosives, controlled substances and/or other security interests are coordinated with the COR to ensure strict control.

- Designating personnel to respond for emergency building/area access assistance to the SEM/PHY and/or the applicable Field Site Security Officer.

B. **All Contractor Personnel.** All Contractor Personnel will adhere to the requirements of this manual, as applicable. These personnel are responsible for:

- Ensuring assigned buildings, areas, and security interests are secured at the end of the business day.

- Ensuring control and accountability of assigned keys and combinations providing access to building/security areas.

- Ensuring they properly wear their FLETC identification badges in accordance with FLETC procedures to aid in ensuring only authorized personnel are allowed access to FLETC facilities, buildings and areas.

PROCEDURES:

A. **Building/Area Security.**

- All FLETC facilities, buildings, and areas will be designated as or in one of the following types of security areas: Property Protection Area (PPA), Limited Area (LA), or Exclusion Area (EA).

i. PPA. A PPA is established to protect government-owned property against damage, destruction, or theft and also to protect sensitive but unclassified (SBU) information. Examples of PPAs are the general areas within a FLETC site's perimeter fence, property storage warehouses, offices, classroom buildings, etc.

ii. LA. An LA is a security area designated for the protection of classified national security information, weapons, explosives, ammunition, pyrotechnics, controlled substances, and other critical security interests. Examples of an LA include buildings/areas designated for the use and storage of classified national security information, weapons storage, etc.; and vaults containing controlled substances.

iii. EA. An EA is a security area in which an individual's mere presence may result in access to classified matter. Examples of an EA are a Secure Compartmented Information Facility and an area approved for open storage of classified national security information.

B. **Security of Buildings and Areas.**

- Both exterior and interior (where possible) doors of buildings must be secured at the close of the business day for those buildings not occupied and/or in use.

- All buildings, areas, vaults, vault-type rooms, and security containers and other storage facilities containing classified national security information, weapons, explosives, ammunition, pyrotechnics, controlled

substances, and other security interests must remain secured when not in use. For the purposes of this requirement, "in use" is under the actual physical control of authorized personnel.

- All areas, offices, and/or storage containers containing SBU information must be secured when not in use.

- The FLETC Security Police will conduct after hours exterior security checks of general areas, buildings, site-specific interior and other security interests, under the terms of the current Security Police contract.

C. **Building /Area Access.**

- Access to FLETC facilities, buildings, and areas will be allowed to authorized individuals only.

- Access to other personnel not regularly assigned to buildings/areas must be in accordance with all applicable FLETC directives and be coordinated through FLETC SEM and/or the site-specific File Site Security Officer (FSSO).

- After hours or other approved access to FLETC buildings/areas to which authorized personnel do not have keys and/or combinations must be coordinated in advance with the COR.

- Keys and combinations providing access to buildings and areas will be issued in accordance with all applicable FLETC directives.

D. **Emergency and After Hours Building/Area Access.**

- FLETC/Glynco, Georgia. Emergency access service may be obtained by calling FLETC SEM and requesting the required service. After normal working hours, emergency requests must be directed to the FLETC Security Police at 912-267-2461.

- FLETC/Artesia, New Mexico. Emergency access service may be obtained by calling the FLETC/Artesia FSSO and requesting the required service. After normal working hours, emergency requests must be directed to the FLETC Security Police at 575-748-8136.

- FLETC/Cheltenham, Maryland. Emergency access service may be obtained by calling the FLETC/Cheltenham FSSO and requesting the required service. After normal working hours, emergency requests must be directed to the FLETC Security Police at 301- 877-8400.

- FLETC/Charleston, South Carolina. Emergency access service may be obtained by calling the FLETC/Charleston FSSO and requesting the required service. After normal working hours, emergency requests must be directed to the FLETC Security Police at 843-974-6305.

FIREARMS AND AMMUNITION

DEFINITIONS:

A. **FLETC Facility** is defined as any training site under the administrative and operational control of the FLETC.

B. **Firearms** are defined as any operable or inoperable gun, to include: revolvers, pistols, semi-auto handguns, shotguns, automatic firearms/guns, air pistols and rifles, BB/pellet and cap guns. This also includes Practical Exercise and Laser Guns as defined below.

C. **Weapons** are any device capable of propelling darts or arrows, such as operable bows (re-curve, compound or cross), launcher devices (used to launch gas/pepper/stun grenades) and knives, other than pocket knives with blades of four inches or less.

D. **Ammunition** describes a cartridge or family of cartridges, including blank ammunition and Non-Lethal Training Ammunition (NLTA), intended for use in various types of firearms identified herein.

RESPONSIBILITIES:

A. **FLETC and PO Contracting Officers (COs) and Contracting Officers Representatives (CORs).** All FLETC and PO COs and CORs will ensure that contractor personnel adhere to the requirements of this manual, as applicable.

B. **Contractors.** All contractor personnel will adhere to the requirements of this manual, as applicable.

PROCEDURES:

E. **General.**

- Signs advising of the policy on introduction of firearms or weapons onto FLETC facilities will be prominently posted at all installation entrances. Upon entering any FLETC facility, ALL personnel must declare possession of any firearm or weapon and/or ammunition to the appropriate security personnel at that site.

- It is the policy of the FLETC that personnel are prohibited from bringing personal (non-government issued) firearms/weapons onto any FLETC facility.

    - Visitors authorized by federal or state permit to carry a firearm on their person or in their vehicle must make alternate storage arrangements for the firearm/weapon prior to entry to a FLETC site.

- If a person is carrying or transporting a personal firearm/weapon not authorized by the provisions of FM 70-09.J, *Firearms and Ammunition*, and/or FM 71-01, *Physical Access Control*, access to the FLETC facility will be denied until alternative storage arrangements for the firearm/weapon have been made.

- Commercial vendors approved through the FLETC vendor demonstration procedures may introduce firearms/weapons/ammunition for demonstrations and review by the FLETC. The Chief, Firearms Division

(FAD) at the respective FLETC sites will be responsible for escort and/or transport of these firearms to and from the appropriate FLETC Range.

IDENTIFICATION BADGES, CREDENTIALS, AND SHEILDS

DEFINITIONS:

A. **FLETC Identification Badges –** Official FLETC ID devices issued to all persons authorized long and short term access to a FLETC facility (i.e., FLETC or Partner Organization (PO) Personal Identity Verification (PIV) card, non-PIV FLETC ID badge (e.g., FLETC or PO Staff badge, FLETC or PO Temporary Staff badge, Frequent Visitor badge, Contractor badge, etc.) are considered sensitive and controlled items.

B. **DHS/FLETC Credentials –** Official DHS/FLETC ID devices (non-Law Enforcement Officer (LEO) and LEO credentials) that are uniquely serial-numbered; that display official FLETC personnel titles; the signatures of the Secretary, DHS, and the bearer; and a photograph of the bearer; that are issued to authorized FLETC Federal staff members that meet specific criteria. These official ID devices are considered sensitive, controlled, and accountable items.

C. **Long-Term Physical Access**. Physical access required on FLETC sites/facilities for extended periods, but not less than six months.

D. **Short-Term Physical Access**. Physical access required on FLETC sites/facilities for short and intermittent periods, but not longer than six months.

RESPONSIBILITIES:

C. **FLETC and PO Contracting Officers (COs) and Contracting Officers Representatives (CORs).** All FLETC and PO COs and CORs will ensure that contractor personnel adhere to the requirements of this manual, as applicable.

- Ensure that Contractor supervisors retrieve issued FLETC Contractor ID badges from their employees who complete their assignment, resign, or have their employment terminated prior to the ID badge expiration date.

- Ensure that Contractor supervisors return all issued FLETC Contractor ID badges to the applicable FLETC and/or PO CO or COR upon termination of or completion of a contract.

- Return all retrieved issued FLETC Contractor ID badges to the FLETC Site Security Force.

D. **Contractors.** All contractor personnel will adhere to the requirements of this manual, as applicable.

- As applicable, ensure the safeguarding and accountability for issued FLETC ID badges.

- Immediately report the loss/theft of any issued FLETC ID badge to the respective CO or COR.

- As applicable, ensure the proper use, accountability, and return of issued ID badges in accordance with the provisions of this manual.

PROCEDURES:

F. **FLETC Identification Badges.**

- ***Issue of FLETC ID Badges.*** The FLETC will issue all applicable contractors, a FLETC ID badge (for long- term access or short-term access) which depicts authorized access to a FLETC facility upon meeting proof of identification and background – clearance criteria.

- ***Wearing of FLETC Issued FLETC ID Badges.*** Except as otherwise expressly provided by this handout, the issued ID badge shall be worn at all times while on all FLETC facilities. The ID badge shall be worn right-side up on the front portion of the body situated between the neck and waistline, displaying the photograph side of the ID badge, and be readily visible.

- ***Exceptions to the Requirement to Wear FLETC Issued ID Badges.*** The **ONLY EXCEPTIONS** to the requirement to wear issued FLETC ID badges are:

i. Those persons engaged in individual physical exercise activities inside of the FLETC Sites' buildings that are officially designated for physical training while wearing the issued FLETC issued physical training uniform.

ii. Those persons engaged in group physical activities (i.e., scheduled student physical exercise/training activities) inside and outside of the FLETC sites' buildings that are officially designated for physical training while wearing the FLETC issued physical training uniform and in the presence/control of FLETC and/or PO instructional staff.

iii. Those persons engaged in physical, work-related activities and/or a supervised, authorized training laboratory or practical exercise scenario where wearing an issued ID badge may jeopardize an individual's safety or negatively impact the training laboratory or scenario. However, all such persons must carry their issued ID badge on their person, readily available for presentation upon request.

1. For the purposes of Contractor Personnel performing FLETC and PO work-related activities, this exception shall apply to them as well only while actually conducting such work and where open display of the ID badge may jeopardize an individual's safety. However, all Contractor Personnel must carry their issued ID badge on their person, readily available for presentation upon request.

iv. Those persons engaged in personal, unscheduled (i.e., before work, during work hours, lunch, after work) and individual physical training/exercise outside of the FLETC Sites' buildings that are officially designated for physical training while wearing or not wearing the FLETC issued physical training uniform, shall wear their issued ID badge or carry their FLETC issued ID badge on their person, readily available for presentation upon request.

v. ***Return of Issued FLETC ID Badges.*** Upon completion of official business with the FLETC, the bearer of a FLETC ID badge shall return their issued badge to the FLETC. Upon completion of contract work, all contractors will return their FLETC ID badge during the checkout process to their contractor supervisor, who will then be responsible for returning ID badges en masse to the FLETC Security Force at the respective FLETC Visitor Control Center for accountability. In addition, contractor ID badges are to be immediately turned over ***to an authorized FLETC official upon*** being officiall***y*** notified that he/she is no longer authorized to possess it.

- ***Loss or Theft of a FLETC Issued ID Badge.*** The loss/theft of an issued ID badge will be reported to the FLETC Site Security Force at the appropriate FLETC facility immediately upon discovery of the loss and an Incident Report completed to document the loss/theft.

i. A Be-On-the-Lookout notice (BOLO) will be submitted for the lost/stolen ID badge to the FLETC Security Forces and posted at all FLETC sites' access control points to ensure it is not used for unauthorized entry.

ii. ***NOTE:*** For more specific FLETC ID badge requirements, refer to FLETC Manual (FM) 71-01, *Physical Access Control*.

G. **Accountability of DHS/FLETC Issued Identification Badges.**

All issued FLETC ID badges are sensitive, controlled, and accountable items. Physical accountability of issued ID badges is conducted by the bearer. Accountability tracking of issued ID badges by a badging data base is conducted by the SEM/PHY and the applicable Field Site Security Officer for the FLETC Field Sites. At all times, FLETC maintains proprietary ownership of FLETC-issued ID badges. FLETC SEM may demand accountability from FLETC Federal and Partner Organization Staff members, and Contractor Personnel at any time.

PHYSICAL ACCESS

DEFINITIONS:

A. **Foreign Nationals (FNs) with Lawful Permanent Resident (LPR) Status.** A non-U.S. citizen who has been officially granted immigration benefits, which include permission to reside and take employment in the U.S.

B. **Long-Term Physical Access.** Physical access required on FLETC sites/facilities for extended periods, but not less than six months.

C. **Personal Identity Verification (PIV) Card.** A Government-wide identification (ID) card which provides for a standardized, secure, and reliable form of ID issued by the Federal Government to its employees and contractor personnel, and approved physical and logical (information technology systems) access.

D. **Short-Term Physical Access.** Physical access required on FLETC sites/facilities for short and intermittent periods, but not longer than six months.

E. **Service Dog.** A guide dog or signal dog individually trained to do work or perform tasks for the benefit of an individual with a disability.

RESPONSIBILITIES:

A. **FLETC and PO Contracting Officers (COs) and Contracting Officers Representatives (CORs).** All FLETC and PO COs and CORs will ensure that contractor personnel adhere to the requirements of this manual, as applicable.

B. **Contractors.** All contractor personnel will adhere to the requirements of this manual, as applicable.

PROCEDURES:

A. **Physical Access Control.** To ensure the well-being of all persons while they are on FLETC sites/facilities, and the protection of all property and sensitive information thereon, policies and procedures have been developed to control physical access to the facilities. Procedures for the physical access and control of persons at all FLETC sites/facilities are based on the purpose and the length of time the physical access is needed. All permanent physical access is issued from the applicable FLETC Site Visitors Center. All FLETC issued physical access control documents (badges, passes, etc.) are required to be returned upon termination of official business or visit. All students, FLETC staff, PO staff, contractors, and visitors are required to obtain authorized admission to FLETC facilities in accordance with applicable procedures documented in this manual.

- **Issue of FLETC ID Badges for Long Term Physical Access.** Two forms of ID (e.g., driver's license; social security card; passport; Department of Defense ID card; Federal, state, or local agency issued ID card; birth certificate, voter registration card, etc.; one of which must be a picture ID) are required for the issue of a long term physical access (over six months) FLETC ID badge (i.e., PIV ID card, non-PIV ID badge, FLETC or PO Temporary Staff ID badge, Frequent Visitor badge, FLETC Retiree ID badge.). ***(NOTE: The only exceptions to this two ID requirement are for the issue of Frequent Visitor ID badges to FLETC and PO staff minor (less than 16 years of age) family members (no form of ID is required).***

a. **Contractors.** Contractor Personnel seeking physical access to the FLETC facilities shall complete a FTC-SEM-17 and submit through the applicable FLETC and/or PO CO, COR, or other Federal staff sponsor, to the applicable FLETC Visitors Center. The expiration date of the Contractor ID badge is determined by SEM's Physical Security Branch (SEM/PHY) or a FLETC Field Site's Field Site Security Officer (SEM/FSSO), based upon contract requirements. Contractor supervisors are responsible for retrieving FLETC-issued Contractor ID badges from their employees who complete their assignment, resign, or have their employment terminated prior to the ID badge expiration date. Contractor supervisors are responsible for returning all Contractor ID badges to the applicable FLETC and/or PO CO or COR upon termination of or completion of a contract.

b. **FNs.** FN FLETC and PO Staff, Frequent Visitors, Contractors (with or without LPR status) seeking long term physical access to the FLETC facilities shall complete FLETC form FTC-SEM-17 and submit through the respective FLETC and PO Federal sponsor to the applicable Visitors Center.

i. In addition to the requirements of the paragraphs above, long-term physical access for FN FLETC and PO staff (including Temporary staff), Contractors, and Frequent Visitors, must be properly coordinated with and authorized by the FLETC Internal Security Program Chief (SEM/INS), at least ten business days for FNs with LPR status and at least 30 business days for FNs without LPR status, prior to physical access being granted.

ii. For full information and requirements to allow FH/LPR contractor personnel access to the FLETC, review *Employment and Prime Contractor Requirements for Non-U.S. Citizens* under Section H of the contract.

- **Issue of FLETC ID Badges for Short Term Physical Access.** Two forms of ID (e.g., driver's license; social security card; passport; Department of Defense ID card; Federal, state, or local agency issued ID card; birth certificate, voter registration card; one of which must be a picture ID) are also required for the issue of a short-term physical access (less than six months) FLETC ID badge (i.e., Student ID badge, non-PIV FLETC Staff ID badge, FLETC or PO Temporary Staff badge, Day Pass, Temporary Pass, etc.).

a. **Day Pass for Vendors.** For vendors (contractors, consultants, etc.) providing the FLETC with authorized and necessary services of an immediate and pressing nature, the FLETC Federal office or agency involved is required to sponsor the vendor and is responsible for the vendor(s) actions while on a FLETC facility. The FLETC or PO Federal sponsor will provide the name, company, and confirmation of U.S. citizenship to the applicable FLETC Visitors Center. Such physical access is restricted to one day in length. Should longer physical access be required then completion of FLETC form FTC-SEM-17 is required. (NOTE: Day Pass physical access is strictly the exception and not the norm. Day Pass physical access for any FNs, including LPRs, is strictly prohibited.)

b. **Infrequent Vendor Deliveries.** Vendors making infrequent deliveries such as freight items, etc., will be issued a Temporary Vehicle Pass and Temporary Visitor's Badge. Physical access will not be permitted unless the vendor presents a formal bill of lading, confirmation of an order, or the applicable Federal FLETC, PO, and/or agency customer is contacted and the physical access requirement is verified. Physical access will be restricted to the delivery point and upon completion of the delivery the vendor must exit the facility without any intermediate stops, returning the Temporary Vehicle Pass and Visitor Badge at a FLETC gate post as they egress.

c. **Frequent Vendor Physical Access.** Vendors requiring frequent and regular physical access (e.g., food deliveries, taxis, shuttle services, etc.) are considered to be contractors and must meet the physical access requirements outlined in this instruction.

i. FN vendors requiring frequent and regular physical access (e.g., food deliveries, taxis, shuttle services, etc.) are considered to be contractors and must meet the additional physical access requirements for FNs outlined in this exhibit and Section H of the contract.

B. **Contractor Sponsorship of Guests.** Contractors on any FLETC facility are prohibited from sponsoring a badge application for a person to gain entry to FLETC.

C. **Employment Applicants.** Persons seeking employment as contract personnel on any FLETC facility will be placed in contact with the specific contractor who will arrange for an interview or meeting to take place at the applicable Visitors Center or other location outside the FLETC facility perimeter.

D. **Additional Restrictions.** Additional restrictions related to the physical access of persons at all FLETC facilities may be employed at a FLETC facility based upon FLETC and the DHS National Terrorism Advisory System's (NTAS) current threat level.

E. **Trade or Business on Center.** Unless authorized by the Office of the Director or higher authority, no contractor personnel, either for himself/herself or for another, will engage in trade or business on any FLETC facility or introduce any article for purposes of trade within or sale thereof business on any FLETC facility or introduce any article for purposes of trade within or sale thereof (e.g., a personal business such as selling magazines, kitchen products, cleaning products; a mobile vehicle cleaning and detailing service; selling privately owned vehicles, motorcycles, and boats, etc.).

F. **Cases Not Covered Herein.** The issuance of FLETC ID badges or pass requirements not covered by this manual will be at the discretion of the FLETC Chief Security Officer (CSO), SEM Physical Security Program Chief, Field Site Security Officers, or any SEM Program Chief acting in an authoritative capacity, and be considered on an individual case by case basis.

G. **Ingress/Egress.** Except as listed below, all vehicles and persons entering/exiting FLETC properties will be controlled by FLETC Security Force personnel assigned to the respective physical access points on the facility.

a. Contractor personnel shall not enter the FLETC outside their normal work hours unless authorized individuals (the applicable CO or COR) make prior notification to the SEM/PHY and/or the Field Site Security Officer, as applicable.

b. The FLETC Security Force, SEM/PHY personnel, FLETC Office of Professional Responsibility (OPR) agents, or those FLETC personnel possessing U.S. Marshals Service (USMS) Special Deputy Appointment and/or USC Title 40, Section 1315 LE authority, will/may make visual identification verifications and inspections of all personnel entering FLETC property.

c. All registrations and badging procedures to allow physical access to FLETC facilities will occur inside the site's Visitors Center.

H. **Prohibition of Introduction of Firearms, Explosives, Other Weapons, and Other Contraband.** While on FLETC facilities, contractors are not allowed to enter with, carry, or possess unauthorized firearms (including disassembled parts/pieces), ammunition, other weapons, explosives, or other contraband (i.e., controlled substances and illegal drugs), either openly or concealed; on their persons or in a vehicle. (NOTE: For the purposes of this policy "other weapons" are defined as: bow(s) and arrow(s), blank/pellet/BB air firearms, blow gun(s) and dart(s), and other such similar weapons.)

I. **Denial and Restriction of Physical Access.** The nature of the work accomplished at the FLETC requires a high standard of personal conduct, past and present. A screening process (background verification, security clearance, etc.) for personnel visitation or employment on FLETC facilities is in place. Physical access to FLETC facilities is a privilege, not a right, and any person may be denied physical access to FLETC facilities or have their physical access privileges to FLETC facilities revoked.

a. Denial of Physical Access. Individuals may have their physical access to FLETC facilities denied if they have a criminal history consisting of specific criminal convictions, their physical access is not in the best interests of the FLETC, they are officially placed in a restricted status, they receive an unfavorable adjudication of their background investigation, or they are the subject of a debarment issued by the Office of Personnel Management (OPM).

i. Criminal History. The criminal history consists of specific convictions, including, but not limited to, any felony conviction within the last six years; any misdemeanor conviction of a serious nature within the last three years, multiple misdemeanor convictions within the last six years, an active "habitual offender" classification for any violation of the law, any conviction for drug sales and trafficking activity, violence against Law Enforcement Officers (LEOs), disdain of legal authority, violations of moral turpitude (e.g., child brutality, child molestation, rape, wrongful death of another, etc.), other crimes of violence, an active arrest warrant for any of the aforementioned crimes, and/or past incidents that would reflect badly on the FLETC in the eyes of the public or that would otherwise pose a threat to the safety and security of FLETC personnel or property. The Personnel Security Officer/Program Chief, SEM/Personnel Security Program, based upon Federal, DHS, and FLETC Personnel Security Program policies and guidance, will make the determination of what constitutes a "serious" misdemeanor. The discontinuance of a "habitual offender" status will not automatically afford the individual physical access to the FLETC. A period of waiting, designated on a case-by-case basis, will be observed prior to permission being granted for physical access to a FLETC facility. (NOTE: In egregious situations, the time periods shown above may be extended or the individual may face debarment in accordance with 5 CFR 731 mandates.)

ii. Not in the Best Interests of the FLETC. Person(s) found to be engaged in activities or behaviors that are not in the best interests of the FLETC (e.g., loss of physical access sponsorship, requesting physical access without official business, involved in domestic situations or disputes, engaging in work stoppages or other disruptions, demonstrations, etc.).

b. **Restriction of Physical Access**. Those persons restricted from physical access to FLETC facilities are notified formally by issue of a Restriction Letter. The Restriction Letter serves as formal and official notice to the recipient that any FLETC-issued passes and/or ID badges previously issued have been rescinded and physical access has been restricted. Restriction Letters may be hand delivered to a recipient or sent to a recipient via certified mail. Any person violating the terms of a Restriction Letter is subject to prosecution for trespassing under the applicable Federal code or state criminal code in which the FLETC facility/site is physically located. The final decision to issue and rescind a Restriction Letter rests solely with the FLETC.

i. **Contractor Personnel and Guests**. Contractor personnel and guests are applicable to this regulation and may be issued a Restriction Letter. Contractor personnel issued a Restriction Letter are not denied an opportunity to work since they can return to work with their employing agency at a site or location other than on a FLETC facility. However, during workplace violence investigations or other investigations regarding conduct by employees or staff which is of a criminal nature or causes security or safety concerns for others, the CSO may temporarily restrict the affected personnel from unfettered physical access to FLETC property and may require FLETC Security Force escort for any authorized physical access.

J. **Inspections of Persons and Vehicles.**

Persons and vehicles physically entering and/or operating on FLETC facilities are subject to inspection for the safety of personnel and the security of government property, equipment, and materials and to prevent the introduction of dangerous, controlled, or illegal substances onto FLETC property. These inspections may be conducted by the FLETC Security Force; SEM/PHY, OPR, and FLETC Federal personnel possessing USMS Special Deputy Appointment and/or USC Title 40, Section 1315 LE authority.

- Individuals physically entering and operating vehicles on FLETC facilities are deemed to have consented to such inspection by entering FLETC facilities in full view of the prominently displayed notices at the entrance(s) advising of this inspection policy.

- Operators of personally owned vehicles (POVs) and government owned vehicles (GOVs) attempting to access a FLETC facility are subject to have their vehicles inspected. ALL contractor vehicles (e.g., those designated as such by signage, that carry equipment, serve as contractor supplied transportation for multiple contractor personnel, that are used as a work vehicle, etc.) attempting to access a FLETC facility are required to be inspected.

- Vehicle operators may decline such an inspection; however, their physical access onto a FLETC facility will be denied until they comply with this requirement.

- Inspections of personally owned vehicles and government vehicles may be conducted on up to a 100 percent of vehicles entering during a given time frame based upon current FLETC and/or DHS security levels and requirements, or conducted using an approved random methodology. Inspections do not necessarily have to be conducted at defined FLETC site physical access points. The inspection may be conducted at internal points onboard a FLETC facility.

- When circumstances warrant (e.g. – elevated DHS and/or FLETC security levels, during a random inspection probable cause is found that a crime is/has/will be committed, an ongoing investigation incidental to an arrest, etc.) an inspection of any person or vehicle entering, exiting, operated by, or located on a FLETC facility may be conducted by security personnel as outlined above.

WORKPLACE VIOLENCE

The FLETC maintains a "zero tolerance" position concerning acts of violence and/or threats of violence on the FLETC. Any acts of violence, to include physical attacks, property damage, direct and indirect threats, however communicated, along with any form of intimidation or harassment employed by any means, will not be tolerated and will warrant an immediate response by the FLETC's management officials with the application of the appropriate corrective action. Additionally, the FLETC ensures fair and consistent administration of this program.

DEFINITIONS:

A. **An Act of Violence:**

- Is any intentional infliction of physical harm or attempt to inflict physical harm against another or aggressive or threatening behavior which results in emotional harm or otherwise places a person's safety and productivity at risk, or deliberate tampering or damage to another's possessions or property, including any government property; and

- Is any verbal, written, or other behavior communicated by any means to include facsimiles, computer-generated communications such as electronic mail, or in any other electronic form which a reasonable person would interpret as a threat to inflict physical harm against another or another's possessions or property, including threats of deliberate tampering with or damage to government property.

B. **Workplace Violence:**

- Is any act or threat of violence committed by an employee or other person against an employee, an employee's family member, a visitor at FLETC facilities or on FLETC property, or anyone with business or official ties to the FLETC when it occurs at a FLETC work site or when it occurs elsewhere if a reasonable person would conclude that the motivation of the perpetrator or the precipitant of the violent act was clearly related to any person's employment at the FLETC.

- Does NOT generally include other aggressive behavior which staff might engage in off duty such as domestic or other types of assault (unless the acts of violence or threats are carried over to property or facilities under the control of the FLETC such as in domestic violence situations involving defined FLETC personnel occurring in the community then continuing onto the FLETC). It also does not include harassment of others, which is not intended to threaten physical harm to another or his or her property, but is otherwise intimidating or creates an unsafe, disruptive, or hostile work environment. However, such behavior is unacceptable and will result in appropriate corrective action being taken against the perpetrator.

C. "**Employee**" includes all FLETC employees, students, Partner Organization and contractor personnel.

D. "**Visitor**" includes guests, family members of the groups identified above, visiting dignitaries and staff, customers, and suppliers.

RESPONSIBILITIES:

A. All employees are expected to interact with each other in ways which promote cooperation and mutual respect, and shall comply with the provisions of this manual.

B. Supervisory personnel and employees should be observant for the following factors, which have been identified as predictive indicators ("Red Flags"), or dangerous behaviors:

- Makes open threats against the agency and managers.
- Obsessively talks of weapons such as "I have quite a gun collection".
- Have open episodes of aggression.
- Engages in sexually explicit conversations or written communications.
- Have had recent physical, financial or family problems.
- Inability to take criticism, overly sensitive.
- History of mental illness, criminal activity, or violent behaviors.
- Continuously tests the limits of acceptable behavior.
- Verbalizes suicidal or homicidal ideations.
- Use of alcohol or drugs or abuse of alcohol or drugs.
- Unexplained fear reactions among co-workers.
- Taking up extra amounts of the manager's time with behavior or performance problems.
- Stalking behaviors.
- Reckless disregard for safety of others.
- Sees violence as only solution to the problem.
- Paranoid obsessions.
- Has an intense sense of injustice or entitlement.
- Expresses fear of losing self-control.

- Self-destructive behaviors, or self-mutilation.

- Recent loss of job, promotion, arbitration or status through disciplinary means (Jacobs, J. and Porter, W., 1999, p. 206).

NOTE: No one can positively identify a potential perpetrator or positively predict an act of workplace violence. Only through awareness and early intervention can such acts be minimized or prevented.

C. Managers. During a threatening situation, the most important role of management above the immediate supervisor is to provide support to the supervisor dealing directly with the threatening employee. Support may include:

- Meeting with the immediate supervisor;

- Contacts with a representative of the CISM/Peer Support Branch (PSP);

- Arranging for or participation in CISM/PSP sponsored counseling sessions for employees; considering temporary relief for the supervisor from regular duties while dealing with the threatening situation; etc.

At all times, managers are responsible for identifying and immediately addressing underlying workplace situations or risk factors that may give rise to stress and/or violence in the workplace.

PROCEDURES:

A. Any employee who is the victim of violence in the FLETC workplace shall take only that action necessary to prevent injury or reduce the risk of further injury to themselves.

B. Employees will immediately notify the nearest supervisor, FLETC Security Police, the Security Specialist at the particular FLETC facility, and/or the SEM when they become aware of or are the victim of any threat or act of violence made in the FLETC workplace against them personally, against their family, or against another individual. The employee will provide the name, if known, and present location of the person making the threat, the specific nature of the threat, and the employee's assessment of the subject's present ability to carry out the threat (e.g., is there evidence that a person who has threatened to shoot someone is actually carrying a gun?).

- Acts of Violence - When any act of violence occurs, FLETC Security Police shall be contacted immediately at 912-267-2911 for FLETC/Glynco; 575-748-8136 for FLETC/Artesia; 301-877-8400 for FLETC/Cheltenham; and 843-974-6305 for FLETC/Charleston.

- Reports of Threats of Violence - When a threat of violence is reported to a supervisor, the supervisor shall forward that reported threat to FLETC Security Police and/or SEM immediately.

  - Direct the individual threatened to a safe area away from the alleged perpetrator. If the threat is immediate and there is reason to believe the perpetrator has the present ability to carry out the threat, the supervisor shall attempt to isolate the perpetrator by directing other employees, customers, visitors, etc., away from the site; if the subject is armed or thought to be armed, no personnel other than FLETC Security Police,

SEM, or respective site Active Shooter Response Team (ASRT) members should attempt to contain or control the subject.

- Weapon Present - Should the active threat or reported threat involve any weapon, immediate contact must be made with FLETC Security Police at 912-267-2911 for FLETC/Glynco; 575-748-8136 for FLETC/Artesia; 301-877-8400 for FLETC/Cheltenham; and 843-974-6305 for FLETC/Charleston.

- After Action: Threats or assaults on the personal safety of employees in the workplace usually have lingering after-effects that must be dealt with in order to restore the employees' mental and emotional wellbeing and enable them to resume full productivity. The victim is not the only person affected; when the safety of one employee is put in jeopardy, all employees experience a reaction which may range from anxiety to fear, depression, insomnia, etc. Professional assistance may be required to relieve these reactions. If necessary, employees may be referred to the Critical Incident Stress Management/Peer Support Program (CISM/PSP), and the Employee Counseling Service Program (ECSP) provider for assistance. CISM/PSP personnel and the ECSP provider are available to counsel the threatening employee and make appropriate referrals, provide support and consultation to victims and supervisors, and participate in debriefing sessions regarding the incident.

OPERATIONS SECURITY (OPSEC) REQUIREMENTS

The FLETC OPSEC Program (SEM/OPS) acts to secure against the inadvertent release or unauthorized disclosure of such information outside established control procedures. Specific, unclassified facts about the FLETC's mission, intentions, capabilities, or activities are considered critical information and must be protected to ensure our adversaries are not successful. OPSEC measures pertaining to a contract require additional requirements to consider such as:

a. FLETC must determine if there is critical information associated with the contract or activities involved in the contract that warrants the inclusion of OPSEC requirements. Consideration shall be given to the type of work being performed and the environment and circumstances in which contract performance will occur. Potential Critical Information that must be protected includes but is not limited to:

(1) Indications of when and where activities will occur (such as tests) which can possibly be targeted and present collection opportunities by foreign intelligence.

(2) The duration of a contract and indications of results (such as in ads, status reports and brochures).

(3) The existence of a contract, services involved and what is being developed in U.S. press releases, stock prospective, etc.

(4) Pictures indicating classified design features or approaches.

(5) The lettering of contracts and identity of subcontractors.

(6) Maps, Aerial Photographs, Floor Plans of the project.

(7) Photographs including facial images.

(8) Official and Personal websites (including social networking sites) revealing details of the project.

(9) Contract specifications detailing how project and contractor personnel are handling/protecting Sensitive But Unclassified (SBU) information.

b. To ensure uniformity in the way OPSEC requirements are presented to industry, the following guidance shall be followed:

(1) Guidance will be appended to basic solicitations or contracts and labeled "OPSEC Requirements."

(2) OPSEC guidance will include Critical Information pertinent to contractual activities and essential secrecy to be maintained and statement of harm if adversaries derive accurate estimates.

c. If OPSEC requirements are necessary, an OPSEC review shall be conducted of the statement of work (SOW) for contracts prior to the time the CO releases the SOW to contract offerors/bidders. The SOW is a publicly released document that can reveal critical information or indicators of critical information. It is important that COs, CORs and PCs work with SEM/OPS and project coordinators, e.g., FLETC Facilities Management Division (FMD), PRO, etc. to identify OPSEC requirements for the scope of work to be performed. The SOW should also undergo a formal content review prior to its release to the public.

d. FLETC and PO COs, CORs, and contractor managers are responsible for ensuring that their respective PCs are aware of this policy and adhere to these requirements. This includes responding to contractor personnel inquiries what photography is permissible and what is not, as well as researching and coordinating interpretation of the policy with SEM/OPS.

e. Contractor personnel may be required to participate in formal OPSEC classroom and/or computer based training (CBT) and briefings, as required.

f. Contractor personnel use of personal still and video photography (including cell phone cameras) is prohibited.

g. Contractor personnel use of still and video photography is limited to ONLY those authorized activities on FLETC facilities that have been approved by the applicable FLETC Training Directorate and/or PO Academy, are part of official visits and media activities coordinated through the FLETC Public Affairs Office (PAO), and/or are part of contract requirements coordinated through the respective CO, COR, and SEM/OPS.

h. Photographing of ANY training activity must be approved in writing by the applicable FLETC Training Directorate and/or PO Academy.

i. Contractor personnel to whom access to FLETC-related SBU and critical information is granted will:

(1) Be aware of and comply with FLETC safeguarding requirements for OPSEC, as applicable.

(2) Be aware that not protecting DHS and FLETC critical information may result in administrative or disciplinary action.

(3) Participate in formal OPSEC classroom and/or CBT and briefings, as required.

j. The Prime Contractor (PC) will coordinate with Project Coordinators, e.g., FMD, and SEM/OPS the conduct of OPSEC reviews, assessments, and evaluations of FLETC contractor products designated for external distribution or publication to include television, radio, film, video, print, photography, and electronic products, for those assigned contracts.

k. As applicable, the PC will ensure that all subordinate contractor personnel will participate with these reviews, surveys, assessments, development of countermeasures, etc., for their respective organization.

l. The PC will ensure documentation of individual contractor personnel attendance at OPSEC briefings and training occurs by following established training documentation procedures, as applicable. Submit all applicable contractor OPSEC training documentation to the respective COR.

SECURITY TRAINING LIST

Company Name:
Contract and/or Task-Delivery-Purchase Order Number:
Subcontract Company Name:

Name	Prime Contractor Employee (Y/N)	Subcontractor Employee (Y/N)	Date Report On Center	Date Of Training

As the authorized representative of (insert company name) concerning Contract Number HSFLxx-xx-x-xxxxx, I hereby certify that the information provided is true and accurate as reported.

Name and Title **Date**

"General Decision Number: GA20260315 05/18/2026

State: Georgia

Construction Types: Building

Counties: Georgia Counties of
Brantley, Glynn and McIntosh

Modification Number	Publication Date
1	01/23/2026
2	05/18/2026

ASBE0048-003 04/01/2025

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 33.90	18.80

ELEC0508-012 09/01/2025

	Rates	Fringes
ELECTRICIAN	$ 33.35	13.40

ENGI0926-005 08/01/2025

	Rates	Fringes
OPERATOR: CRANE	$ 38.53	16.08

ENGI0926-006 08/01/2025

	Rates	Fringes
OPERATOR: FORKLIFT	$ 32.93	16.08

IRON0387-002 01/01/2025

	Rates	Fringes
IRONWORKER: ORNAMENTAL	$ 32.00	15.05
IRONWORKER, STRUCTURAL	$ 32.00	15.05

IRON0387-002 01/28/2025

	Rates	Fringes
IRONWORKER: ORNAMENTAL	$ 32.00	15.05
IRONWORKER, STRUCTURAL	$ 32.00	15.05

PLUM0188-003 08/01/2025

	Rates	Fringes
PLUMBER	$ 35.45	17.55
PIPEFITTER	$ 35.45	17.55

SHEE0085-023 07/01/2025

	Rates	Fringes
SHEET METAL WORKER	$ 38.29	17.40

SUGA2017-030 04/15/2021

	Rates	Fringes
PAINTER: SPRAY	$ 16.29	0.00
PAINTER (BRUSH AND ROLLER)	$ 16.14	0.00
OPERATOR: ROLLER	$ 14.05	0.00
OPERATOR: LOADER	$ 14.86	0.00
OPERATOR: GRADER/BLADE	$ 16.80	0.00
OPERATOR: BULLDOZER	$ 15.23	0.00
OPERATOR: BOBCAT/SKID STEER/SKID LOADER	$ 26.53	12.32
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE	$ 19.78	10.28
LABORER: PIPELAYER	$ 12.55	1.90
LABORER: COMMON OR GENERAL	$ 12.69	0.58
CEMENT MASON/CONCRETE FINISHER	$ 10.00	0.00
CARPENTER	$ 19.13	0.30

UAVGGA0001 01/01/2025

	Rates	Fringes
IRONWORKER: REINFORCING	$ 31.31	17.68

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than "SU", "UAVG", "SA", or "SC" denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The "SU" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

"SU" wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the

discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ?SA? identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

BID BOND

(See instructions on reverse)

DATE BOND EXECUTED *(Must not be later than bid opening date)*

OMB Control Number: 9000-0045
Expiration Date: 8/31/2022

Paperwork Reduction Act Statement - This information collection meets the requirements of 44 USC § 3507, as amended by section 2 of the Paperwork Reduction Act of 1995. You do not need to answer these questions unless we display a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 9000-0045. We estimate that it will take 1 hour to read the instructions, gather the facts, and answer the questions. Send only comments relating to our time estimate, including suggestions for reducing this burden, or any other aspects of this collection of information to: General Services Administration, Regulatory Secretariat Division (M1V1CB), 1800 F Street, NW, Washington, DC 20405.

PRINCIPAL *(Legal name and business address)*

TYPE OF ORGANIZATION *("X" one)*

☐ INDIVIDUAL ☐ PARTNERSHIP ☐ JOINT VENTURE

☐ CORPORATION ☐ OTHER *(Specify)*

STATE OF INCORPORATION

SURETY(IES) *(Name and business address)*

PENAL SUM OF BOND					BID IDENTIFICATION	
PERCENT OF BID PRICE	AMOUNT NOT TO EXCEED				BID DATE	INVITATION NUMBER
	MILLION(S)	THOUSAND(S)	HUNDRED(S)	CENTS		
					FOR *(Construction, Supplies or Services)*	

OBLIGATION:

We, the Principal and Surety(ies) are firmly bound to the United States of America (hereinafter called the Government) in the above penal sum. For payment of the penal sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally. However, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us. For all other purposes, each Surety binds itself, jointly and severally with the Principal, for the payment of the sum shown opposite the name of the Surety. If no limit of liability is indicated, the limit of liability is the full amount of the penal sum.

CONDITIONS:

The Principal has submitted the bid identified above.

THEREFORE:

The above obligation is void if the Principal - (a) upon acceptance by the Government of the bid identified above, within the period specified therein for acceptance (sixty (60) days if no period is specified), executes the further contractual documents and gives the bond(s) required by the terms of the bid as accepted within the time specified (ten (10) days if no period is specified) after receipt of the forms by the principal; or (b) in the event of failure to execute such further contractual documents and give such bonds, pays the Government for any cost of procuring the work which exceeds the amount of the bid.

Each Surety executing this instrument agrees that its obligation is not impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the Government. Notice to the surety(ies) of extension(s) is waived. However, waiver of the notice applies only to extensions aggregating not more than sixty (60) calendar days in addition to the period originally allowed for acceptance of the bid.

WITNESS:

The Principal and Surety(ies) executed this bid bond and affixed their seals on the above date.

PRINCIPAL

SIGNATURE(S)	1. (Seal)	2. (Seal)	3. (Seal)	Corporate Seal
NAME(S) & TITLE(S) *(Typed)*	1.	2.	3.	

INDIVIDUAL SURETY(IES)

SIGNATURE(S)	1. (Seal)	2. (Seal)
NAME(S) *(Typed)*	1.	2.

CORPORATE SURETY(IES)

SURETY A	NAME & ADDRESS		STATE OF INCORPORATION	LIABILITY LIMIT ($)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		

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STANDARD FORM 24 (REV. 8/2016)
Prescribed by GSA - FAR (48 CFR) 53.228(a)

SURETY B	NAME & ADDRESS		STATE OF INCORPORATION	LIABILITY LIMIT ($)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY C	NAME & ADDRESS		STATE OF INCORPORATION	LIABILITY LIMIT ($)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY D	NAME & ADDRESS		STATE OF INCORPORATION	LIABILITY LIMIT ($)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY E	NAME & ADDRESS		STATE OF INCORPORATION	LIABILITY LIMIT ($)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY F	NAME & ADDRESS		STATE OF INCORPORATION	LIABILITY LIMIT ($)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY G	NAME & ADDRESS		STATE OF INCORPORATION	LIABILITY LIMIT ($)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		

INSTRUCTIONS

1. This form is authorized for use when a bid guaranty is required. Any deviation from this form will require the written approval of the Administrator of General Services.

2. Insert the full legal name and business address of the Principal in the space designated "Principal" on the face of the form. An authorized person shall sign the bond. Any person signing in a representative capacity (e.g., an attorney-in-fact) must furnish evidence of authority if that representative is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved.

3. The bond may express penal sum as a percentage of the bid price. In these cases, the bond may state a maximum dollar limitation (e.g., 20% of the bid price but the amount not to exceed _____ dollars).

4. (a) Corporations executing the bond as sureties must appear on the Department of the Treasury's list of approved sureties and must act within the limitations listed therein. The value put into the LIABILITY LIMIT block is the penal sum (i.e., the face value) of the bond, unless a co-surety arrangement is proposed.

(b) When multiple corporate sureties are involved, their names and addresses shall appear in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)." In the space designated "SURETY(IES)" on the face of the form, insert only the letter identifier corresponding to each of the sureties. Moreover, when co-surety arrangements exist, the parties may allocate their respective limitations of liability under the bond, provided that the sum total of their liability equals 100% of the bond penal sum.

(c) When individual sureties are involved, a completed Affidavit of Individual Surety (Standard Form 28) for each individual surety, shall accompany the bond. The Government may require the surety to furnish additional substantiating information concerning its financial capability.

5. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Corporate Seal"; and shall affix an adhesive seal if executed in Maine, New Hampshire, or any other jurisdiction requiring adhesive seals.

6. Type the name and title of each person signing this bond in the space provided.

7. In its application to negotiated contracts, the terms "bid" and "bidder" shall include "proposal" and "offeror."

DISCLOSURE OF LOBBYING ACTIVITIES

Approved by OMB
0348-0046

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure.)

1. Type of Federal Action:	2. Status of Federal Action:	3. Report Type:
☐ a. contract b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	☐ a. bid/offer/application b. initial award c. post-award	☐ a. initial filing b. material change **For Material Change Only:** year _____ quarter _____ date of last report _____

4. Name and Address of Reporting Entity:	5. If Reporting Entity in No. 4 is a Subawardee, Enter Name and Address of Prime:
☐ **Prime** ☐ **Subawardee** Tier _____, *if known*: **Congressional District**, *if known*: 4c	**Congressional District**, *if known*:
6. Federal Department/Agency:	**7. Federal Program Name/Description:** CFDA Number, *if applicable*: _____
8. Federal Action Number, *if known*:	**9. Award Amount,** *if known*: $
10. a. Name and Address of Lobbying Registrant (*if individual, last name, first name, MI*):	**b. Individuals Performing Services** (*including address if different from No. 10a*) (*last name, first name, MI*):

11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Signature: _____

Print Name: _____

Title: _____

Telephone No.: _____ Date: _____

Federal Use Only:

Authorized for Local Reproduction
Standard Form LLL (Rev. 7-97)

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employeeof a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.

2. Identify the status of the covered Federal action.

3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.

4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.

5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.

6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizationallevel below agency name, if known. For example, Department of Transportation, United States Coast Guard.

7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.

8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."

9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.

10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.

    (b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).

11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503.

FINANCIAL QUESTIONNAIRE

(To be completed by Financial Institution and submitted by Offeror)

The Department of Homeland Security (DHS), Federal Law Enforcement Training Centers (FLETC), is considering award of a contract to this firm. Prior to award, the FLETC requests the financial information listed below with regard to this firm. To be responsive to FLETC's needs, it is requested that you complete this financial questionnaire with regard to this firm and upon completion **place the completed questionnaire in a sealed envelope showing the return address of the financial institution and forward it to the Offeror shown below**. The requested information must be received by the contractor **no later than** _____

Prospective Contractor for which information is being requested:

Name: _____

Address: _____

_____

Phone Number: _____

Point of Contact: _____

_____

Signature of Prospective Contractor or Contractor Representative Requesting Financial Information

Name of Financial Institution: _____

Address: _____

_____

Phone Number: _____

Account Number: _____

Type of Account: _____

Average Balance Figure : _____

Does the Contractor have a line of credit? ☐ Yes ☐ No

What is the limitation? _____

Remaining Balance: _____

What is the Contractor's relationship with the bank?

☐ Outstanding ☐ Satisfactory ☐ Other (explain): _____

How long has the Contractor been a client? _____

Name and Title of person providing the above information: _____

_____

Signature of person providing the above information

Please provide any additional comments that may help determine the business and financial reputation and integrity of the prospective contractor on a separate sheet.

WORKER RIGHTS

UNDER THE DAVIS-BACON ACT

FOR LABORERS AND MECHANICS WORKING ON FEDERAL OR FEDERALLY ASSISTED CONSTRUCTION PROJECTS

The law requires employers to display this poster where workers can readily see it.

PREVAILING WAGES

You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this notice for the work you perform.

OVERTIME

You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few exceptions.

ENFORCEMENT

Contract payments can be withheld to ensure workers receive wages and overtime pay due, and liquidated damages may apply if overtime pay requirements are not met. Davis-Bacon contract clauses allow contract termination and debarment of contractors from future federal contracts for three years. A contractor who falsifies certified payroll records or induces wage kickbacks may be subject to civil or criminal prosecution, fines and/or imprisonment.

APPRENTICES

Apprentice rates apply only to apprentices properly registered under approved federal or state apprenticeship programs.

RETALIATION

The law prohibits discharging or otherwise retaliating against workers for filing a complaint, cooperating in an investigation, or testifying in a proceeding under the Davis-Bacon and Related Acts.

PROPER PAY

If you do not receive proper pay, or require further information on the applicable wages, contact the Contracting Officer listed below:

or contact the U.S. Department of Labor's Wage and Hour Division.

WAGE AND HOUR DIVISION
UNITED STATES DEPARTMENT OF LABOR

866-487-9243
dol.gov/agencies/whd

WH1321 REV 07/24

ATTACHMENT 26

PROPOSAL DATA SHEET

PROJECT TITLE: B164 Ammo Cart Building

SOLICITATION: 70LGLY26RSSB00019

PROJECT LOCATION: 1311 Chapel Crossing Road, FLETC, Glynco GA

1. Name of Firm:
   Address:
   Phone:
   Fax:
   E-mail:
   DUNS #

If a joint venture or contractor-subcontractor association of firms, list the individual firms and briefly describe the nature of the association and provide a DUNS number for each firm.

Firm 1:

Firm 2:

Firm 3:

Nature of Association:

2. AUTHORIZED NEGOTIATORS. FAR 52.215-11

The Offeror represents that the following persons are authorized to negotiate on its behalf with the Government in connection with this Request for Proposals (RFP).

Name of Person Authorized to Negotiate:

Negotiator's Address:
Negotiator's Telephone:
Negotiator's E-mail:

ATTACHMENT 27

PAST PERFORMANCE QUESTIONNAIRE ASSESSMENT SHEET

70LGLY26RSSB00019

B164 Ammo Cart Building

The Offeror's proposal **shall** include the Past Performance Questionnaire Summary Sheet to provide a summary of the PPQs included and/or submitted to clients. The summary sheet at a minimum shall include the following: 1) Project name; 2) Team member submitting the project; 3) Contract Number, 4) Construction percent completed at the time of the solicitation, 5) Scheduled completion date; and 6) Design Build (D/B) or Design-Bid-build (D/B/B).

No.	Project Name	Contractor	Contract #	Construction % Complete @ Time of Solicitation	Scheduled Completion Date	D/B, D/B/B
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

ATTACHMENT 28

FLETC PAST PERFORMANCE QUESTIONNAIRE (Form PPQ-0)

CONTRACT INFORMATION (Contractor to complete Blocks 1-4)

1. Contractor Information

Firm Name: CAGE Code:
Address: DUNs
Number:
Phone Number:
Email Address:
Point of Contact: Contact Phone Number:

2. Work Performed as: ☐ Prime Contractor ☐ Sub Contractor
☐ Joint Venture ☐ Other (Explain)
Percent of project work performed:
If subcontractor, who was the prime (Name/Phone #):

3. Contract Information

Contract Number:
Delivery/Task Order Number (if applicable):
Contract Type: ☐ Firm Fixed Price ☐ Cost Reimbursement ☐ Other
(Please specify):
Contract Title:
Contract Location:

Award Date (mm/dd/yy):
Contract Completion Date (mm/dd/yy):
Actual Completion Date (mm/dd/yy):
Explain Differences:

Original Contract Price (Award Amount):
Final Contract Price (*to include all modifications, if applicable*):
Explain Differences:

4. Project Description:

Complexity of Work ☐ High ☐ Med ☐ Routine
How is this project relevant to project of submission? (*Please provide details such as similar equipment, requirements, conditions, etc.*)

CLIENT INFORMATION (Client to complete Blocks 5-8)
5. Client Information Name: Title: Phone Number: Email Address:
6. Describe the client's role in the project:
1. 7. Date Questionnaire was completed (mm/dd/yy)**:**
8. Client's Signature:

NOTE: FLETC REQUESTS THAT THE CLIENT COMPLETES THIS QUESTIONNAIRE AND SUBMITS DIRECTLY BACK TO THE OFFEROR. THE OFFEROR WILL SUBMIT THE COMPLETED QUESTIONNAIRE TO FLETC WITH THEIR PROPOSAL, AND MAY DUPLICATE THIS QUESTIONNAIRE FOR FUTURE SUBMISSION ON FLETC SOLICITATIONS. CLIENTS ARE HIGHLY ENCOURAGED TO SUBMIT QUESTIONNAIRES DIRECTLY TO THE OFFEROR. HOWEVER, QUESTIONNAIRES MAY BE SUBMITTED DIRECTLY TO FLETC. PLEASE CONTACT THE OFFEROR FOR FLETC POC INFORMATION. THE GOVERNMENT RESERVES THE RIGHT TO VERIFY ANY AND ALL INFORMATION ON THIS FORM.

ATTACHMENT 28

ADJECTIVE RATINGS AND DEFINITIONS TO BE USED TO BEST REFLECT YOUR EVALUATION OF THE CONTRACTOR'S PERFORMANCE

RATING	DEFINITION	NOTE
(E) Exceptional	Performance meets contractual requirements and exceeds many to the Government/Owner's benefit. The contractual performance of the element or sub-element being assessed was accomplished with few minor problems for which corrective actions taken by the contractor was highly effective.	To justify an Exceptional rating, identify multiple significant events and state how they were of benefit to the Government. A singular benefit, however, could be of such magnitude that it alone constitutes an Exceptional rating. Also, there should have been NO significant weaknesses identified.
(VG) Very Good	Performance meets contractual requirements and exceeds some to the Government's/Owner's benefit. The contractual performance of the element or sub-element being assessed was accomplished with some minor problems for which corrective actions taken by the contractor were effective.	To justify a Very Good rating, identify a significant event and state how it was a benefit to the Government. There should have been no significant weaknesses identified.
(S) Satisfactory	Performance meets minimum contractual requirements. The contractual performance of the element or sub-element contains some minor problems for which corrective actions taken by the contractor appear or were satisfactory.	To justify a Satisfactory rating, there should have been only minor problems, or major problems the contractor recovered from without impact to the contract/order. There should have been NO significant weaknesses identified. A fundamental principle of assigning ratings is that contractors will not be evaluated with a rating lower than Satisfactory solely for not performing beyond the requirements of the contract/order.

(M) Marginal	Performance does not meet some contractual requirements. The contractual performance of the element or sub-element being assessed reflects a serious problem for which the contractor has not yet identified corrective actions. The contractor's proposed actions appear only marginally effective or were not fully implemented.	To justify Marginal performance, identify a significant event in each category that the contractor had trouble overcoming and state how it impacted the Government. A Marginal rating should be supported by referencing the management tool that notified the contractor of the contractual deficiency (e.g., management, quality, safety, or environmental deficiency report or letter).
(U) Unsatisfactory	Performance does not meet most contractual requirements and recovery is not likely in a timely manner. The contractual performance of the element or sub-element contains serious problem(s) for which the contractor's corrective actions appear or were ineffective.	To justify an Unsatisfactory rating, identify multiple significant events in each category that the contractor had trouble overcoming and state how it impacted the Government. A singular problem, however, could be of such serious magnitude that it alone constitutes an unsatisfactory rating. An Unsatisfactory rating should be supported by referencing the management tools used to notify the contractor of the contractual deficiencies (e.g., management, quality, safety, or environmental deficiency reports, or letters).
(N) Not Applicable	No information or did not apply to your contract	Rating will be neither positive nor negative.

ATTACHMENT 28
TO BE COMPLETED BY CLIENT

PLEASE CIRCLE THE ADJECTIVE RATING WHICH BEST REFLECTS YOUR EVALUATION OF THE CONTRACTOR'S PERFORMANCE.

1. QUALITY:					
a) Quality of technical data/report preparation efforts	E N	VG	S	M	U
b) Ability to meet quality standards specified for technical performance	E N	VG	S	M	U
c) Timeliness/effectiveness of contract problem resolution without extensive customer guidance	E N	VG	S	M	U
d) Adequacy/effectiveness of quality control program and adherence to contract quality assurance requirements (without adverse effect on performance)	E N	VG	S	M	U
2. SCHEDULE/TIMELINESS OF PERFORMANCE:					
a) Compliance with contract delivery/completion schedules including any significant intermediate milestones. *(If liquidated damages were assessed or the schedule was not met, please address below)*	E N	VG	S	M	U
b) Rate the contractor's use of available resources to accomplish tasks identified in the contract	E N	VG	S	M	U
3. CUSTOMER SATISFACTION:					
a) To what extent were the end users satisfied with the project?	E N	VG	S	M	U
b) Contractor was reasonable and cooperative in dealing with your staff (including the ability to successfully resolve disagreements/disputes; responsiveness to administrative reports, businesslike and communication)	E N	VG	S	M	U
c) To what extent was the contractor cooperative, businesslike, and concerned with the interests of the customer?	E N	VG	S	M	U
d) Overall customer satisfaction	E N	VG	S	M	U
4. MANAGEMENT/ PERSONNEL/LABOR					
a) Effectiveness of on-site management, including management of subcontractors, suppliers, materials, and/or labor force?	E	VG	S N	M	U

b) Ability to hire, apply, and retain a qualified workforce to this effort	E	VG	S N	M	U
c) Government Property Control	E	VG	S N	M	U
d) Knowledge/expertise demonstrated by contractor personnel	E	VG	S N	M	U
e) Utilization of Small Business concerns	E	VG	S N	M	U
f) Ability to simultaneously manage multiple projects with multiple disciplines	E	VG	S N	M	U
g) Ability to assimilate and incorporate changes in requirements and/or priority, including planning, execution and response to Government changes	E	VG	S N	M	U
h) Effectiveness of overall management (including ability to effectively lead, manage and control the program)	E	VG	S N	M	U
5. COST/FINANCIAL MANAGEMENT					
a) Ability to meet the terms and conditions within the contractually agreed price(s)?	E	VG	S N	M	U
b) Contractor proposed innovative alternative methods/processes that reduced cost, improved maintainability or other factors that benefited the client	E	VG	S N	M	U
c) If this is/was a Government cost type contract, please rate the Contractor's timeliness and accuracy in submitting monthly invoices with appropriate back-up documentation, monthly status reports/budget variance reports, compliance with established budgets and avoidance of significant and/or unexplained variances (under runs or overruns)	E	VG	S N	M	U
d) Is the Contractor's accounting system adequate for management and tracking of costs? *If no, please explain in Remarks section.*	Yes			No	
e) If this is/was a Government contract, has/was this contract been partially or completely terminated for default or convenience or are there any pending terminations? *Indicate if show cause or cure notices were issued, or any default action in comment section below.*	Yes			No	
f) Have there been any indications that the contractor has had any financial problems? *If yes, please explain below.*	Yes			No	
6. SAFETY/SECURITY					
a) To what extent was the contractor able to maintain an environment of safety, adhere to its approved safety plan,	E	VG	S N	M	U

and respond to safety issues? (Includes: following the users rules, regulations, and requirements regarding housekeeping, safety, correction of noted deficiencies, etc.)	
b) Contractor complied with all security requirements for the project and personnel security requirements.	E VG S N M U
7. GENERAL	
a) Ability to successfully respond to emergency and/or surge situations (including notifying COR, PM or Contracting Officer in a timely manner regarding urgent contractual issues).	E VG S N M U
b) Compliance with contractual terms/provisions *(explain if specific issues)*	E VG S N M U
c) Would you hire or work with this firm again? *(If no, please explain below)*	Yes No
d) In summary, provide an overall rating for the work performed by this contractor.	E VG S N M U

ATTACHMENT 28

Please provide responses to the questions above (*if applicable*) and/or additional remarks. Furthermore, please provide a brief narrative addressing specific strengths, weaknesses, deficiencies, or other comments which may assist our office in evaluating performance risk *(please attach additional pages if necessary)***:**

ATTACHMENT 28-A – EXPERIENCE INFORMATION FORM

PROJECT NO. (Check One): ☐ - 1 ☐ - 2 ☐ - 3 ☐ - 4 ☐ - 5

1) Name of Offeror:

2) Project Title:

3) Contract Number: 4) Contract Amount: $

5) Contract Completion Date: 6) Contract Duration:

7) Description of the Project's Scope and Magnitude:

8) Location of Project:

9) Customer/Owner Information:

A) Name of Customer/Owner

B) Name of Point of Contact

C) Contact Phone Number

D) Contact Email Address

10) Type of work:
☐ New Construction ☐ Renovation ☐ Repair ☐ Alteration

11) Type of Contract:
☐ Design/Build ☐ Design-Bid-Build ☐ Other (explain)

If Design/Build, what percentage of the total design was provided to you.

12) Describe any problems encountered with this project and corrective action taken.

13) Describe involvement of the designers during the construction phase of the job.

14) Was structural steel the main structural component of the building? Describe those components.

15) Was this project's Sustainability Certified? Describe Sustainablity components of project.

16) Attach any copies or photographs of industry awards/special recognitions, etc, received for this project.

_____ _____

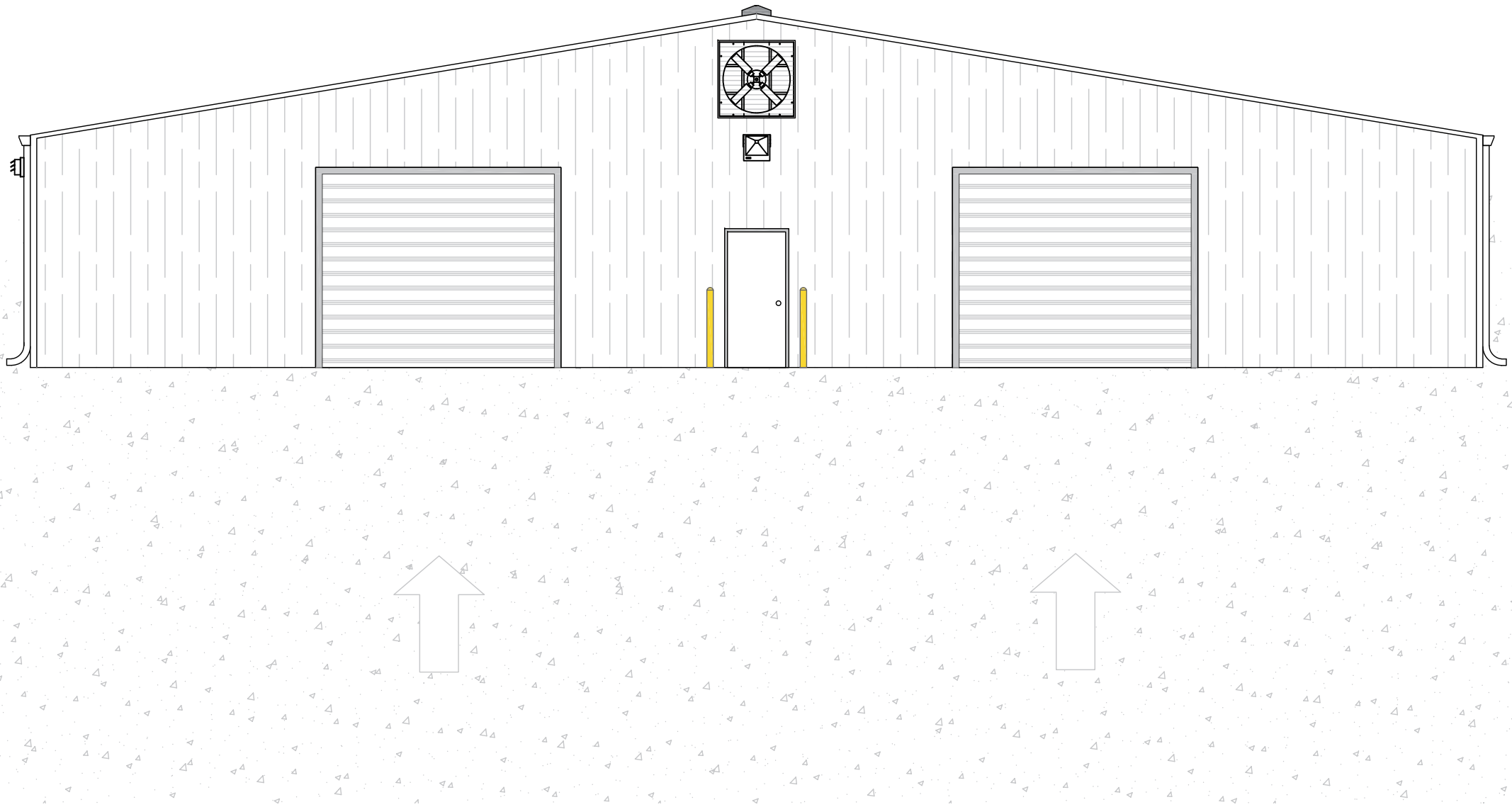
Signature Date

_____

Title

_____

Company Name



O.D. FIRING RANGE CART CHARGING FACILITY

FEDERAL LAW ENFORCEMENT TRAINING CENTERS

GLYNCO, GA
ARTESIA, NM
CHELTENHAM, MD
CHARLESTON, SC

Building 166 Range Cart Facility
AT GLYNCO

BUILDING #
TBD

FOR OFFICIAL USE ONLY

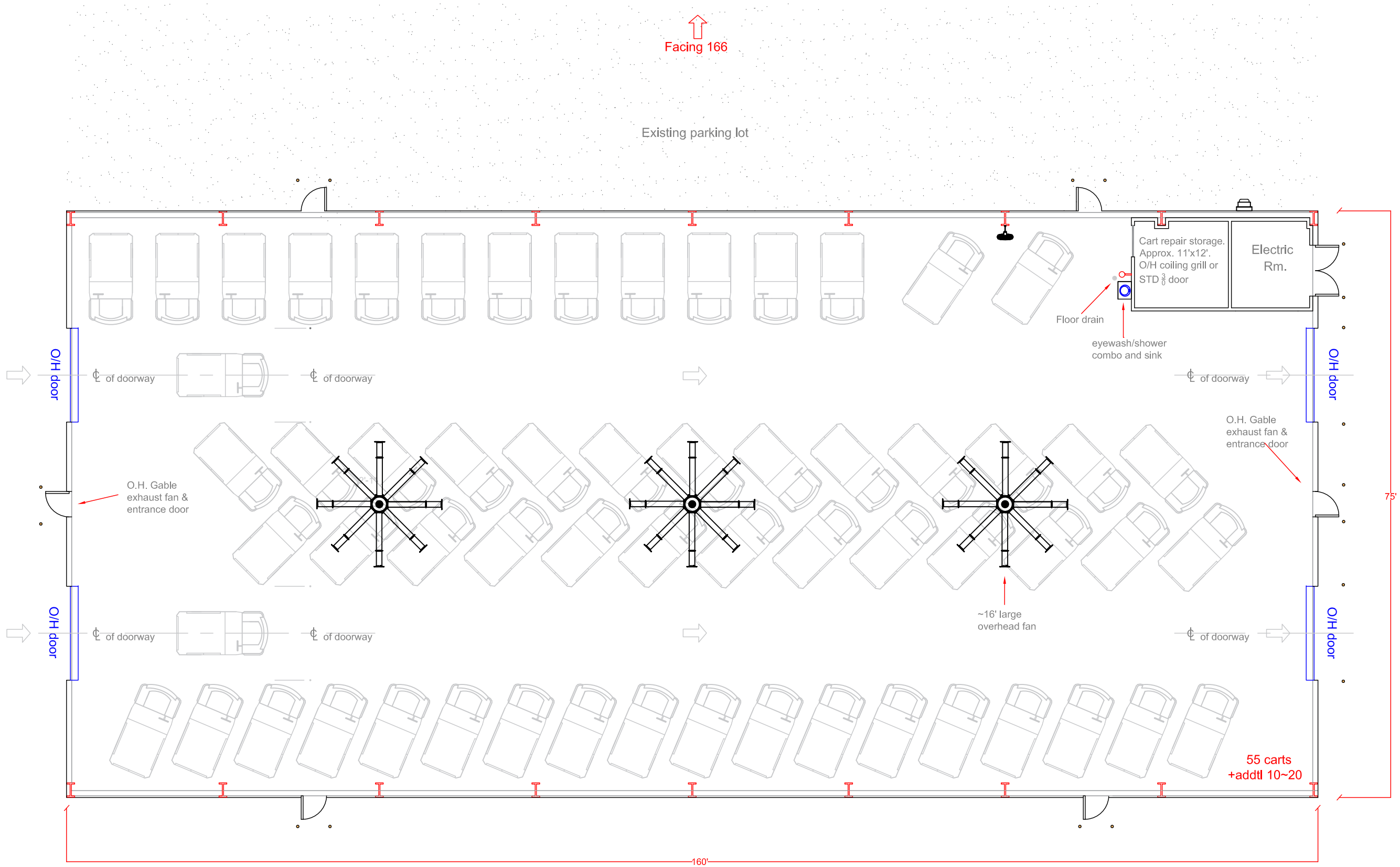
COVER SHEET

DRAWING NO:	GLY101050522
PROJECT NO:	-- --
ISSUE DATE:	05/06/2022
DRAWN BY:	STB
CHECKED BY:	RH
LOCATION:	GLYNCO, GA

COVER

SHEET 01 OF 04

_S SUBMITTAL



FEDERAL LAW ENFORCEMENT TRAINING CENTERS

GLYNCO, GA
ARTESIA, NM
CHELTENHAM, MD
CHARLESTON, SC

Building 166 Range Cart Facility
AT GLYNCO

BUILDING #
TBD
FOR OFFICIAL USE ONLY

COVER SHEET

DRAWING NO:	GLY101050522
PROJECT NO:	-- --
ISSUE DATE:	05/06/2022
DRAWN BY:	STB
CHECKED BY:	BW
LOCATION:	GLYNCO, GA

COVER

SHEET 01 OF 04

SUBMITTAL

BG0164 OD Range cart charging and storage shelter

Solicitation #_____

BID SCHEDULE

Base Contract CLIN'S

	Description		CLIN Total
	BG0164 OD range cart charging and storage shelter/facility		
	Total Contract Grand Total		

SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE	OF	PAGES
	70LGLY26RSSB00019	☐ SEALED BID (IFB) INVITATION FOR BID ☒ NEGOTIATED (RFP) REQUEST FOR PROPOSAL	06/12/2026	1		75

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.
	26SUGLY0203C01	

7. ISSUED BY CODE 70LGLY	8. ADDRESS OFFER TO
DEPARTMENT OF HOMELAND SECURITY FEDERAL LAW ENFORCEMENT TRAINING CENTERS 1131 CHAPEL CROSSING RD GLYNCO GA 31524	Federal Law Enforcement Training Center Building 681 Attn: Courtney Brown 1131 Chapel Crossing Glynco Ga 31524

9. FOR INFORMATION CALL	a. NAME	b. TELEPHONE NO. *(Include area code) (NO COLLECT CALLS)*
	Courtney Brown	(912) 267-2083

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying number, date)*

This Request for Proposal will result in a Single Firm Fixed Price Contract Award for the design and construction of Building 164 Ammo Range Cart Storage Facility at Federal Law Enforcement Training Center, Glynco GA.

This acquisition is a 100% total small business set-aside.

The Government will utilize the acquisition strategy Best Suited Then Negotiate when analyzing proposals. The Government will also utilize Federal Acquisition Regulation procedures (FAR) 15.404, Price Negotiation when evaluating Offeror's proposal.

The construction magnitude for this requirement is between $1,000,000 and $5,000,000.00.

The contract duration will be for a period not to exceed 180 calendar days after issuance of Notice to Proceed.

Continued...

11. The contractor shall begin performance within 1 calendar days and complete it within 180 calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☐ mandatory ☒ negotiable. *(See _____).*

12a. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? *(If "YES", indicate within how many calendar days after award in Item 12b.)*	12b. CALENDAR DAYS
☒ YES ☐ NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

a. Sealed offers in original and 1 copies to perform the work required are due at the place specified in Item 8 by 1400 *(hour)* local time 07/15/2026 (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

b. An offer guarantee ☐ is, ☒ is not required.

c. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

d. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*	15. TELEPHONE NO. *(Include area code)*
	16. REMITTANCE ADDRESS *(Include only if different than Item 14.)*
CODE FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirement stated in Item 13d. Failure to insert any number means the offeror accepts the minimum in Item 13d.)*

AMOUNTS ▶

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each)

AMENDMENT NUMBER										
DATE.										

20a. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*	20b. SIGNATURE	20c. OFFER DATE

AWARD *(To be completed by Government)*

21. ITEMS ACCEPTED:

Continued...

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified)* ▶	ITEM	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO THE UNITED STATES CODE AT ☐ 10 U.S.C. 3204(a) ( ) ☐ 41 U.S.C. 3304(a) ( )
26. ADMINISTERED BY 70LGLY DEPARTMENT OF HOMELAND SECURITY FEDERAL LAW ENFORCEMENT TRAINING CENTERS 1131 CHAPEL CROSSING RD PRO BLDG 681 GLYNCO GA 31524		27. PAYMENT WILL BE MADE BY

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return* 1 *copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

☐ 29. AWARD *(Contractor is not required to sign this document.)* Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30a. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*		31a. NAME OF CONTRACTING OFFICER *(Type or print)* Courtney P. Brown	
30b. SIGNATURE	30c. DATE	31b. UNITED STATES OF AMERICA BY	31c. DATE

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	The North American Industry Classification System (NAICS) Code for this solicitation shall be 236220, Commercial and Institutional Building Construction. A site visit is scheduled for June 23, 2026, at 10:30am at FLETC Building 200. Upon arrival, attendees should report to the commercial gate a minimum of 30 minutes prior to the application screening process, then proceed to Building 200. All personnel who are not currently badged will need to complete and return Day Pass applications for all attendees no later than June 18, 2026, at 10:00am to the attention of Project Manager, Emerson Floyd at Emerson.Flyd@fletc.dhs.gov. Please coordinate receipt of badge applications and submission with Mr. Emerson Floyd. Delivery: 180 Days After Notice to Proceed Delivery Location Code: FLETC GL DEPARTMENT OF HOMELAND SECURITY FEDERAL LAW ENFORCEMENT TRNG CTR 1131 CHAPEL CROSSING RD ATTN: Courtney Brown BLDG: 681 GLYNCO GA 31524				
0001	This is a Firm-Fixed Price CLIN, The Contractor shall design and construct Building 164 Ammo Range Cart Storage Facility, at FLETC Glynco GA. All work shall be performed in accordance with the scope of work, specifications, and drawings as attached to the subject Solicitation. Product/Service Code: Z2AA Product/Service Description: REPAIR OR ALTERATION OF OFFICE BUILDINGS Period of Performance: 07/15/2026 to 01/11/2027 Offerors shall provide a statement of compliance with FAR 52.222-50, Combating Trafficking in Persons, requirements and confirm subcontractors will accomplish a statement of compliance upon award.				

B - Supplies or Services/Prices

Clauses

See Continuation Sheet, Standard Form 1442. Also, please refer to Exhibit A for completion of the Bid Schedule and proposal breakdown

C - Description/Specifications

The Contractor shall provide all necessary parts and labor to supervise, direct, and accomplish the design and construction of Building 164 Range Cart Storage Facility, at FLETC Glynco. The contractor shall field verify all existing conditions and notify the Contracting Officer (CO) immediately of any discrepancies. Exact location of work to be identified by Contracting Officer's Representative (COR) during site visit. The Contractor shall furnish all labor, materials, equipment, and supervision necessary to accomplish the work detailed herein. The Contractor will also verify all quantities, dimensions, and site conditions in the field. The Contractor will supply all supplemental and related miscellaneous work to comply with the scope of work as indicated in the Specifications, Statement of Work, and/or Contract. Please refer to SOW Attachment 1 for a detailed project description.

See Section J, Attachment 1 & 1A for the complete technical requirements associated with this action.

D - Packaging and Marking

Clauses

D.1 Packing and Marking

(a) All shipments of materials, equipment and/or supplies to the project site shall be addressed to the Contractor and not the U. S. Government. Preservation, packaging and packing shall be in accordance with standard practices for commercial packaging.

(b) Government personnel are not authorized to accept deliveries for the contractor, nor are they responsible for off-loading shipments. A contractor representative must be present to accept deliveries.

D.2 Payment and Postage and Fees

a) The Contractor shall pay all postage and fees related to submitting information (including forms, reports, etc.) to the Contracting Officer.

E - Inspection and Acceptance

Clauses

52.246-12 Inspection of Construction. (AUG 1996)

52.246-21 Warranty of Construction. (MAR 1994)

F - Deliveries or Performance

F.1 Existing Furniture, Equipment, and Materials

The Contractor shall move all furniture, equipment, and materials for access to work. Upon completion of work, such items shall be repositioned to their original location. Personal items, computers, telephones, audio-visual equipment, and facsimile machines will be removed by the Government. All other items will be removed and replaced by the Contractor. Some offices are fully furnished and others are less congested. It will be the Contractor's responsibility to remove and replace, or if unable to remove the furniture, to cover and protect, all furniture for the duration of the contract. Additional compensation may be negotiated for rooms that are considered “libraries’ or “volume storage areas.”

F.2 Occupancy of Premises

The premises may be occupied during the performance of the work.

F.3 Submittals & Preconstruction Conference

Submittals are due no later than 14 calendar days after award. For more information regarding submittals, please see Attachment 1, Scope of Work and Submittal Specifications.

Clauses

52.211-10 Commencement, Prosecution, and Completion of Work. (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 5 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 180 calendar days after the date the Contractor receives the notice to proceed. The time stated for completion shall include final cleanup of the premises.

(End of clause)

52.211-13 Time Extensions. (SEP 2000)

52.242-17 Government Delay of Work. (APR 1984)

G - Contract Administration Data

Clauses

G.1 Accounting and Appropriation Data

Funds have been reserved for this acquisition. The accounting appropriation data applicable for this acquisition will be provided in any resulting contract.

G.2 Identification of Correspondence

All correspondence and data submitted by the Contractor under this contract will reference the contract number and title.

G.3 Contracting Officer

The Contracting Officer (CO) for award of the contract will be Courtney Brown from the office listed below:

FLETC, Procurement Division
Specialized Services Branch (SSB)
Bldg 681, 1131 Chapel Crossing Road
Brunswick, GA 31524

The Contracting Officer (CO) for administration of the contract will be Courtney Brown.

G.4 Payment Office Address

Department of Homeland Security
FLETC Finance Division/Contract Payments
Building 681 (BFD)
Glynco, Georgia 31524
(See G.8, Invoices)

G.5 Contracting Officer

The Contracting Officer has the overall responsibility for the administration of this contract. All communication pertaining to contractual or administrative matters under the contract shall be addressed to the Contracting Officer. The Contracting Officer alone, without delegation, is authorized to take actions on behalf of the Government to amend, modify or deviate from the contract terms, conditions, requirements, specifications, details and/or schedules. However, the CO may delegate certain other responsibilities to authorized representatives.

G.6 Designation of Contracting Officer's Representative

As indicated in Homeland Security Acquisition Regulation (HSAR) clause 3052.242-72, Contracting Officer's Representative, the Contracting Officer will designate a Contracting Officer's Representative (COR) to perform functions under the contract such as review or inspection and acceptance of services, and other functions of a technical nature. The Contracting Officer will provide a written notice of such designation to the Contractor within five working days after contract award. The designation letter will set forth the authorities and limitations of the COR under the action. The Contracting Officer cannot authorize the COR or any other representative to sign documents, such as contracts, contract modifications, etc., that require the signature of the Contracting Officer. In no event, will any matter deviating from the terms of this contract be effective or binding unless formalized by contractual documents executed by the Contracting Officer.

The Contracting Officer for this contract should be informed as soon as possible of any actions or inaction by the Contractor or the Government which could change any of the terms, conditions, or completion times stated in the contract. On all matters pertaining to contract terms, the Contractor must communicate with the Contracting Officer. Whenever, in the opinion of the Contractor, the COR requests effort outside the scope of the contract, the Contractor should so advise the COR. If a disagreement exists as to contractual coverage, the Contracting Officer should be notified immediately, preferably in writing if time permits. Proceeding with work without contractual coverage could result in nonpayment.

G.7 Bonds – 52.228-1 Bid Guarantee (SEP 1996) (Not required for subject requirement)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds-

(1) To unsuccessful bidders as soon as practicable after the opening of bids; and

(2) To the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

(c) The amount of the bid guarantee shall be [20%] percent of the bid price or $3,000,000.00 the amount of the proposed price, whichever is less.

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee. 52.232-40 Providing Accelerated Payments to Small Business Subcontractors. (DEC 2013)

(a) Upon receipt of accelerated payments from the Government, the Contractor shall make accelerated payments to its small business subcontractors under this contract, to the maximum extent practicable and prior to when such payment is otherwise required under the applicable contract or subcontract, after receipt of a proper invoice and all other required documentation from the small business subcontractor.

(b) The acceleration of payments under this clause does not provide any new rights under the Prompt Payment Act.

(c) Include the substance of this clause, including this paragraph (c), in all subcontracts with small business concerns, including subcontracts with small business concerns for the acquisition of commercial items.

G.8 Payment & Performance Bond (REQUIRED for subject requirement)

a. Performance and Payment bonds. The Contractor shall be required to provide both payment and performance bonds.

b. Penal sums. The penal sums of the performance and payment bonds shall equal one hundred percent (100%) of the contract price.

c. The Contractor shall furnish all bonds or alternative payment protection no later than ten (10) calendar days after receipt of the notice of award. The furnishing of bonds is a part of contract performance and failure to provide bonds within the time specified shall be grounds for default.

G.9 Individual Surety

a. As prescribed in FAR 28.200, individual sureties are acceptable for all types of bonds except position schedule bonds. In order for the Contracting Officer to determine the acceptability of individuals proposed as sureties, all bidders/offerors who submit bonds which are executed by individual sureties are required to furnish the following information in support of SF 28, Affidavit of Individual Surety, with the bond(s):

1. A complete description of real property offered, supported by proof of title, such as by title opinion or abstract of title, and a certified appraisal or tax assessment;

2. C.P.A. certified balance sheet(s) and income statement(s) with a signed opinion for each individual surety;

3. Independent certified appraisal of net value of property offered;

4. Independent Certification by licensed attorney or Title Company of liens or other encumbrances which exist against all property listed;

5. A current list of all other bonds on which the individual is a surety and bonds for which the individual is requesting to be a surety, together with a statement as to the percent completion of these bonded jobs.

6. Copy of latest Federal and State Income Tax returns including all schedules.

b. This information is necessary to enable the Government to evaluate the sufficiency of the surety. Failure to furnish this information may result in non-approval of the surety and a determination of non-responsibility.

G.10 Irrevocable Letter of Credit

As prescribed in FAR 28.204-3, an Irrevocable Letter of Credit is acceptable for all types of bonds, if all provisions of FAR 28.204-3 and FAR -14 are met. FAR -14 requires a specific format for the Irrevocable Letter of Credit and the letter from the Financial Institution confirming an Irrevocable Letter of Credit.

G.11 Invoices

a. All payments under this contract will be made by electronic funds transfer (EFT) in accordance with FAR 52.232.33, Payment by Electronic Funds Transfer—System for Award Management (See Section I). An invoice is a written request for payment under the contract for supplies delivered or for service rendered. Invoices shall cite the contract number, quantity, price, and total amount of invoice. The sample invoice forms will be given to the successful offeror at the Pre-Construction meeting after contract award. In accordance with FAR Clause 52.232-5, Payments Under Fixed Price Construction Contracts (Section I), the Contractor shall furnish proper certification required by paragraph (d) on progress payments.

b. Invoices shall be prepared by the Contractor and submitted and distributed as follows:

Email to the attention of the Contracting Officer at courtney.p.brown@fletc.dhs.gov .

c. The Government will pay all proper invoices per the provisions of FAR 52.232-5, Payments Under Fixed Price Construction Contracts, and FAR 52.232-27 Prompt Payment for Construction Contracts (see Section I).

d. Payment will be based on invoices submitted by the Contractor for satisfactorily completed work. Upon verification of work actually performed and receipt of a proper invoice and any required contractor submittals, invoices will be processed for payment.

e. Submission of the invoice certifies that all employees and subcontractors have been notified of the United State Government’s zero tolerance policy regarding trafficking in persons, and the actions that will be taken for violations of this policy.

G.12 Payment to Contractor

a. The Provisions of the clause entitled "Payment Under Fixed-Price Construction Contracts" prescribed in FAR 52.232-5 are supplemented as follows:

1. In preparation of estimates, the Contracting Officer (CO) may authorize materials delivered to the site and preparatory work done to be taken in to consideration if these items are specifically identified in the accepted Schedule of Values (SOV) (if applicable) for the contract. The CO will only authorize payment for stored materials in the SOV that are considered high value; long lead or difficult to obtain; or are specialty items specifically manufactured for this project. Standard construction materials such as CMU block, conduit, wire, paint, etc. will be paid for upon satisfactory installation of the material. Payment requests for authorized stored materials in the SOV must be accompanied by an invoice showing a detailed description, quantity, cost of the materials, and evidence of contractor payment for the materials. If payment is authorized, the Contractor will be paid the lesser of the material invoice amount, or the SOV line item amount. Any remaining SOV line item balance shall be redistributed to the material installation activity, or another activity as acceptable to the Contracting Officer. The Contractor remains responsible at all times for the proper storage and

protection of all materials. Retention will be withheld from future payment applications for improperly stored materials for which the Contractor has been previously paid.

2. The FLETC will not normally authorize payment for material stored off-site. In the event the FLETC and the Contractor both agree that it is in interest of the project to consider payment for off-site material, the following conditions at minimum must be met:

a) Material properly stored in a bonded warehouse;

b) Submission of a paid invoice indicating the contractor has title to the material

c) Arrangements made for government representative to inventory the material

d) A defined material delivery date to the project

3. In accordance with FAR 52.232-5, Payments under Fixed-Price Construction Contracts, if the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved.

b. No payment request (invoice) will be processed by the Contracting Officer when the Contractor's payroll submittals and/or those of any subcontractor are not current. This means the Contracting Officer must have in hand payroll submittals for the prime Contractor and all subcontractors up through and including the week immediately prior to the date on the invoice. Any invoice received wherein the Contractor has not adhered to this policy will be promptly returned to the Contractor and will not be processed until payroll submittals are brought up to date by the Contractor.

G.13 Final Payment

Final payment will not be made until all work is completed and accepted, all submittals have been received and approved, warranties received, and final cleanup of the premises is accomplished.

G.14 Daily Report to Inspector

The Contractor’s Superintendent shall complete for each day and submit electronically daily, prior to 10 AM of the following day, Form FTC-FMD-42 (12/09), Daily Report to Inspector to the Government Project Manager, Building 200, FLETC, Glynco GA. The Daily Report should contain a clear accounting of the time, location, type and quantity of work that took place. All sections shall be filled out or a comment made indicating that “this does not apply at this time”. If the proper procedure is not followed, a “Contract Construction Compliance Notice” will accompany the returned document or in the case of no report, the “CCCN” will be your notification.

G.15 Special Note

Sections K, L and M of this solicitation will be physically removed from any resultant award; however; Section K will be deemed to be incorporated by reference.

Special Contract Requirements Clauses

H - Special Contract Requirements

Clauses

H.1 DIRECTIVES, REGULATIONS, AND INSTRUCTIONS (JUL 2013)

a. The Contractor, its personnel, subcontractors, their personnel, and representatives shall become acquainted with and fully comply at all times with the Federal Law Enforcement Training Centers (FLETC) Regulations, Directives, and Instructions. Any individual shall be subject to removal from the Center for noncompliance.

b. In the event of a conflict between this contract and any FLETC Directive, Regulation or Instruction the contract prevails.

H.2 OPERATION ON THE FACILITY (JUL 2013)

H.2.1 Safety

a. The Contractor shall conduct the operation(s) under this contract in strict conformance with all FLETC safety directives and Federal, State, and local requirements and with all applicable provisions of 29 CFR Part 1910 and 1926 of the Occupational Safety and Health Act (OSHA).

b. The Contractor shall conform to all safety rules and requirements in effect on the award date of this contract and shall take such additional precautions as the Contracting Officer (CO) may reasonably require for safety and accident prevention purposes while performing any work under this contract. The Contractor agrees to take all reasonable steps and precautions to prevent accidents and preserve the life and health of Contractor and Government personnel performing in any way under this contract.

c. The Contractor shall make contract personnel available for Government furnished safety and occupational training for an estimate of two (2) hours to four (4) hours annually per individual. Government furnished training may include Quality, Safety and Occupational requirements.

H.2.2 Accident Reports

Within 24-hours of occurrence, the Contractor shall prepare a report of all job-related accidents and injuries occurring on FLETC property. The Contractor shall deliver the report to the Contracting Officer Representative (COR). The Contractor shall maintain an accurate record of all accidents resulting in personal injury, death, trauma, or occupational illness or disease; exposure to hazardous materials (asbestos, lead, etc); and, all injuries reported on the Occupational Safety and Health Administration (OSHA) Form 300, Log of Work-Related Injuries and Illnesses.

H.2.3 Occupational Hazards

The Contractor shall comply with all elements of OSHA Safety and Health Standards and the FLETC Safety and Health Directives.

H.2.4 Fire Prevention

Contract personnel shall report fires immediately upon detection. The Contractor shall observe all OSHA, FLETC, and National Fire Prevention Association (NFPA) requirements for handling and storage of combustible supplies, materials, waste, and trash. If combustible materials are to be stored on the premises, the Contractor shall obtain Government approval, label the containers with the fire hazard potential of the materials and store the containers in fire-rated locking metal cabinets.

H.2.5 Traffic Regulations

Contractor and subcontractor personnel operating motor vehicles on the FLETC shall observe traffic regulations and posted speed limits except as defined elsewhere in this contract. The only exception to posted speed limits is passing jogging formations, when speed shall be reduced to 15 mph. Traffic laws are enforced on the Center and violations shall be assessed penalty points, which can result in revocation of driving privileges on Center.

H.2.6 Weapons

Contractor and subcontractor personnel are not permitted to bring privately owned firearms, weapons, or ammunition on the Center. This restriction includes handguns, rifles, shotguns, hunting bow and arrows, etc. All privately owned firearms, weapons, and ammunition must be surrendered/checked in at the main gate upon entry to the FLETC.

H.2.7 Supervision of Contractor Personnel

The Contractor's personnel shall remain under the Contractor's direct supervision at all times. Although the Government will coordinate direction within the scope of the contract, detailed instructions for the Contractor's personnel's performance and supervision shall remain the sole responsibility of the Contractor.

H.3 MEDICAL TREATMENT

a. Only emergency medical care is available in Government facilities to Contractor personnel who suffer on-the-job injury. The Government will NOT perform physical examinations on Contractor personnel except as specified elsewhere in this contract. Government emergency vehicles and medical personnel may be used as the first point of treatment in emergency situations affecting Contractor personnel suffering pain or whose life or limb may be in danger.

b. Transfer to other than Government medical treatment facilities shall be affected by the Local Rescue Squad or Security Vehicle as determined necessary by attending medical authorities. The Contractor shall render payment for care at the rates established by the CO as equitable with like services rendered in the local community.

Upon receipt of a statement of charges, reimbursement will be made by the Contractor as a credit to the next billing invoice. Cost of these emergency services shall be incurred and borne by the Contractor as non-reimbursable by the Government.

H.4 SUBCONTRACTING

The Government reserves the right to approve or disapprove subcontractors for any work required by this contract. The Contractor shall obtain the CO's written approval of all subcontractors and provide copies of approved subcontracts.

H.5 ORDER OF WORK

The Contractor shall arrange the work so that it will not cause interference with the normal conduct of Government business or with the progress of other Contractors' projects. The Contractor shall submit all work schedules for approval by the COR. The Contractor shall adhere to the established schedules.

H.6 OTHER CONTRACTS

The Government may award third party contracts for additional work at or near the site of work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the CO. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

H.7 DISRUPTION OF CONTRACTOR WORK SCHEDULE

The Contractor shall promptly notify the CO and the COR when it appears that Government activities or personnel or other contractor's projects are hindering the effective execution of its work efforts.

H.8 RIGHTS OF THE GOVERNMENT TO PERFORM FUNCTIONS WITH ITS OWN PERSONNEL

a. The Government reserves the right to perform or supplement performance of contract functions with Government personnel during periods of disaster, war emergencies, police actions, or acts of God. Such performance shall not constitute a breach of contract by the Government within the meaning of the contract clause entitled "Default".

b. The Contractor agrees under such circumstances to permit the Government to use any essential Contractor-furnished property. The Government will equitably compensate the Contractor for use of such property.

H.9 GOVERNMENT PERFORMANCE OF SERVICES DURING LABOR STRIKES

a. Because the services called for under this contract are of critical importance to the FLETC, the Government reserves the right to take over or supplement performance of this contract in the event of a labor strike by the Contractor's personnel which impairs

the Contractor's ability to satisfactorily perform the contract. Under such circumstances and at the direction of the CO, the Contractor agrees not to interfere in any way with Government performance. The Contractor further agrees under such circumstances to permit the Government to use any essential contractor-furnished property. The Government will equitably compensate the Contractor for use of such property.

b. The Contractor will not be entitled to payment for any performance period, in part or in total, during which the Government assumes performance under this clause. This clause does not limit the Government's rights under any other clause of this contract, including but not limited to, "Default (Fixed-Price Supply and Services)", "Termination for Convenience of the Government (Fixed-Price)", and "Inspection of Services-Fixed-Price."

H.10 CONSERVATION

Contractor and subcontractor personnel shall actively participate in all energy conservation efforts and programs applicable to work performed under this contract. The Contractor shall instruct its personnel and subcontractors in utilities conservation policies.

H.11 LABOR RELATIONS

a. The Contractor shall maintain satisfactory labor relations with its personnel. Representatives of the Contracting Office will not participate in labor relation matters unless disputes develop that interfere with the proper performance of the contract, at which time the representative may endeavor to assist in settling the difficulty.

b. The Contractor shall provide the CO with a copy of any collective bargaining agreement applicable to personnel performing on this contract.

H.12 AFFIRMATIVE PROCUREMENT OF BIOBASED PRODUCTS UNDER SERVICE AND CONSTRUCTION CONTRACTS

The Contractor shall provide a complete list of biobased products purchased to carry out the contract requirements. The list shall be provided to the point of contact listed in FAR 52.223-2, Affirmative Procurement of Biobased Products Under Service and Construction Contracts, on each anniversary date of award. The products list shall be organized into the following three categories: Biobased products, Green products and all other products. The Contractor shall list volume to be used and total cost for each individual product in each category.

H.13 PHOTOGRAPHY

No photography, of any nature, is allowed while on the FLETC without the written authorization of the CO. Submit photography requests to the CO at least two (2) business days prior to anticipated photo session.

H.14 CONDUCT OF PERSONNEL

The CO may require the Contractor to remove from the job site any individual under this contract for reasons of misconduct, security, suspected or found to be under the influence of alcohol, drugs, or other incapacitating agent. Contractor and subcontractor personnel shall be subject to dismissal from the premises upon determination by the CO that such action is in the best interests of the Government. The CO has the authority to bar individuals from the installation. Such removal from the job site or dismissal from the premises shall not relieve the Contractor of the requirement to provide sufficient personnel to perform the services as required by this performance work statement.

H.15 CONTRACTOR VEHICLES

a. All Contractor vehicles operated on Government property shall be in operable condition, maintained in good repair, and meet all local, State and Federal safety requirements. Vehicles found to be unsafe or unable to function as designed shall be removed from the job site immediately. Each vehicle operated by the Contractor under this contract shall, at all times, display a valid state license plate and safety inspection sticker, if applicable.

b. All Contractor vehicles shall be operated in accordance with the FLETC traffic regulations.

c. Should a vehicle fail to meet the standards, the Contractor shall be liable of any resultant delays (including jeopardizing their performance report rating on contract schedules).

d. The Contractor's name and telephone number shall be conspicuously legible on both sides of all Contractor vehicles and over-the-road equipment.

H.16 PERMITS

a. The Contractor shall without additional expense to the Government obtain all appointments, licenses, and permits required for the prosecution of the work and for compliance with all applicable Federal, State and local laws, regulations, and codes. Evidence of such shall be provided to the CO upon request.

b. The Contractor shall ensure that all Contractor personnel who will be driving a vehicle in support of this contract possess required license, prior to driving that vehicle. This specifically includes personnel operating FLETC Government owned vehicles in the performance of roles.

H.17 ENVIRONMENTAL PROTECTION

The Contractor shall comply with all applicable environmental protection requirements including all Federal, State and local laws and regulations. All environmental protection matters shall be coordinated with the CO or designated representative. In the event that a regulatory agency assesses a monetary fine against the Government for violations caused by the Contractor, or contractor equipment, personnel, etc., the Contractor shall reimburse the Government for that portion of the fine and associated costs for which the Contractor is responsible.

H.18 ACCESS TO BUILDINGS

It shall be the Contractor's responsibility, through the COR, to obtain access to buildings and to arrange for each room/area to be opened and closed as necessary in performance of contract requirements. The Contractor shall be responsible for safeguarding all Government property and securing facilities, equipment, and materials at the end of each work period.

H.19 KEY CONTROL

a. Keys to include keyless entry cards or other similar control devices will be issued to the Contractor as appropriate. The Contractor shall receive, service, and account for all keys issued for use in the performance of this contract. The Contractor shall develop a system of key control and submit the written plan for the CO's approval five (5) days prior to contract start. This plan shall become a part of the quality control plan. The Contractor's plan shall ensure that all keys and lock combinations issued to the Contractor by the Government are not lost, misplaced, or used by unauthorized persons.

b. Neither the Contractor, nor any Contractor personnel, shall duplicate or fabricate any Government key in its custody. Should replacement keys be required, the Contractor shall submit a WRITTEN REQUEST to the COR. The Contractor shall report loss or unauthorized duplication of Government issued keys to the CO or his/her designated representative within 48 hours of learning of the loss or duplication by Contractor and subcontractor personnel.

c. The Contractor shall control access to all Government provided lock combinations to preclude unauthorized entry. The Contractor shall immediately notify the COR when lock combinations have been compromised.

d. Should the security of a facility become compromised by the loss of a key by Contractor personnel, the Contractor shall be responsible for replacement cost for rekeying of locks or lock replacements as determined appropriate by the CO. In the event a master key is lost or duplicated, all locks and keys for that system shall be replaced and replacement cost borne by the Contractor.

e. Contractor personnel shall not allow anyone the use of any Government key in their possession. They shall not open locked rooms or areas to permit entrance by persons other than Contractor personnel performing assigned duties. Any room unlocked by Contractor at the start of work shall not be left unattended during the service process and shall be re-locked by Contractor personnel after completion of their service duties.

H.20 DISCLOSURE OF INFORMATION

a. Neither the Contractor nor any contract personnel shall disclose, or cause to be disseminated, any information concerning the operations which could result in or increase the likelihood of the possibility of a breach of the FLETC (or its partner organizations) security or interrupt the continuity of its operations.

b. No Contractor personnel or representative shall provide any information related to the FLETC activities to any element of the media without the CO's prior written permission. This prohibition includes publicity releases, recruitment notices, etc. All inquiries, comments, or complaints arising from or in connection with the performance of this contract shall be directed to the CO, if dissemination of official information may be required for resolution.

c. Under no circumstances shall the Contractor, or anyone acting on behalf of the Contractor, refer to the equipment or services furnished pursuant to the provisions of this contract in, or in connection with, any news release or commercial advertising, without first obtaining the explicit written consent of the CO.

d. Should any such reference appear in any news release or commercial advertising issued by or on behalf of the Contractor without such prior consent, the Government shall consider institution of all remedies available under the provisions of this contract. Disclosure of information relating to this contract to any person not entitled to receive it, or failure to safeguard any sensitive information that may come to the Contractor or any person under his control, may subject the Contract, his agents, or employees to criminal liability under Title 18, Section 793 and 798, of the United States Code.

e. Deviations from, or violations of, any of the provisions of this paragraph will, in addition to all other criminal and civil remedies provided by law, subject the Contractor to immediate termination for default and the individual(s) involved to a withdrawal of the Government's acceptance and approval of performance on the FLETC sites.

H.21 ADVERTISING OF AWARD

The Contractor shall not refer to awards in commercial advertising in such a manner as to state or imply that the product or service provided is endorsed or preferred by the Federal Government or is considered by the Government to be superior to other products or services.

H.22 DAMAGE REPORTS

In all instances where Government property or equipment is damaged by Contractor personnel, the Contractor shall submit a full written report of the facts and extent of such to the COR within 24 hours.

H.23 PROPERTY DAMAGE AND PERSONAL INJURIES

The Contractor shall assume full responsibility for any and all damages or claims for damage for injury to persons, property, or equipment which results from any service performed under this contract. The Contractor shall repair or replace to the satisfaction of the CO or his representative any surfaces, fixtures, furnishings, structures, equipment, material, or supplies which were damaged by Contractor personnel. The Contractor shall abide by the decision of the CO whether to repair or to replace items, property, or structures when damage is caused by any of the above. The Contractor shall accomplish such repair or replacement at no cost to the Government within five (5)

business days following occurrence of the damage unless otherwise agreed upon by the CO.

H.24 INDEMNITY AND LIABILITY

a. The Contractor shall exercise reasonable care and use the Contractor's best efforts to prevent accidents, injury, or damage to all persons and property in and about the work and to the facility or part(s) thereof upon which work is done.

b. The Contractor shall indemnify and hold harmless the Government against any and all liability claims and costs for injury to any property (Government or otherwise) arising from the occupancy, use, service, operation or performance of work in connection with this contract resulting in whole or in part from the negligent acts or fault of the Contractor or any subcontractor, or any employee, agent or representative of the Contractor or any subcontractor.

c. The Government will in no way be responsible for damages or loss occasioned by fire, theft, and accident or otherwise to the Contractor's stored supplies, materials, equipment, or its personnel's personal belongings.

d. The Contractor shall indemnify the Government against any and all liability claims for injuries, or death of any person and for loss or damage to any property occurring in connection with the occupancy, use, service, operation, or performance of work in connection with this contract resulting from the negligent acts or fault of the Contractor, any subcontractor, any employee, agent, or representative of the Contractor or subcontractor.

H.25 CONTRACTOR LIABILITY FOR ACTS OF GOD

The Contractor shall not be held responsible for damages incurred as a result of an Act of God, including but not limited to: flood, lightning, hurricane, tornado, earthquake, and unusually severe weather conditions documented by the National Weather Service as differing from the norm for this geographical area. The Contractor shall take all necessary precautions or measures to protect Government property and equipment if warning is given. If the Contractor is found to be negligent in his efforts to minimize damages, the Government shall hold the Contractor liable for those damages and associated costs.

H.26 INSURANCE (JUL 2013)

a. The Contractor shall procure and maintain insurance at the Contractor’s expense during the term of the contract and any extensions. Before starting work under this contract, the Contractor shall certify to the CO in writing that the required insurance has been obtained. Within 10 days after the award of this contract, the Contractor shall furnish to the CO a certificate of insurance as evidence of the existence of the following insurance coverage in amounts not less than the minimum amounts specified below:

1) Comprehensive General Liability: $200,000 per person and $500,000 per accident for bodily injury and $50,000 per occurrence for property damage

2) Automobile Insurance: $200,000 per person and $500,000 per occurrence for bodily injury and $20,000 per occurrence for property damage

3) Standard Workers' Compensation and Employer's Liability Insurance in the minimum amount of $100,000.

b. The general liability policy shall name "The United States of America, acting by and through the Department of Homeland Security (DHS), Federal Law Enforcement Training Center (FLETC)" as an additional insured with respect to operations performed under this contract.

c. The Certificate of Insurance shall provide for a minimum of 30 days written notice to the CO by the insurance company prior to cancellation or material change in policy coverage.

H.27 HOLIDAYS

a. "Federal holidays" to be used to compute labor hours in the solicitation and contract, are:

1. New Year's Day - 1 January
2. Birthday of Martin Luther King, Jr. - Third Monday of January
3. Washington's Birthday - Third Monday of February
4. Memorial Day - Last Monday of May
5. Juneteenth - 19 June
6. Independence Day - 4 July
7. Labor Day - First Monday of September
8. Columbus Day - Second Monday of October
9. Veterans Day - 11 November
10. Thanksgiving Day - Fourth Thursday of November
11. Christmas Day - 25 December

a) Any other day designated by Federal statute, Executive Order, or the President's proclamation.

b) When any holiday falls on a Saturday, the preceding Friday is observed. When any holiday falls on a Sunday, the following Monday is observed. Observance of such days by Government personnel shall not by itself be cause for an additional period of performance or entitlement of compensation except as set forth within the contract.

c) Occasionally Federal holidays will be declared normal training days and full Contractor support will be required. Notice of this requirement will be given to the Contractor at least one week in advance.

d) The Contractor shall NOT receive premium rates for any special declared holiday for Federal employees (e.g., national day of mourning for death of a former president).

H.28 HOURS OF OPERATION

Normal work hours are from 7:30 a.m. through 4:30 p.m., Monday through Friday unless otherwise defined in individual specification sections.

Notwithstanding the provisions of FAR clause 52.222-4, Contract Work Hours and Safety Standards Act – Overtime Compensation, work will NOT be permitted outside normal work hours, on Saturdays, Sundays, or federal holidays unless coordinated and approved by the Government Project Manager and Contracting Officer in advance. A request to work outside normal work hours must be submitted a minimum of two (2) working days in advance of the date on which such work is anticipated. The exclusion of work on Saturdays, Sundays, and holidays has been considered in computing the performance time of this contract.

H.29 PHYSICAL AND PERSONNEL SECURITY REQUIREMENTS (JUL 2013)

H.29.1 General Requirements

a. Contractor and subcontractor personnel in the performance of this contract or any representative of the Contractor entering the FLETC shall abide by all FLETC security regulations which may be in effect during the contract period. Any such individual(s) shall be subject to those security inspections which may be deemed necessary by the FLETC to ensure that no security violations occur during the course of the contract. It shall be the Contractor's responsibility to ensure that each applicant who is expected to perform on FLETC facilities or that requires routine access to FLETC facilities shall complete the most current versions of FLETC FTC-SEM-17 Badge Application Request form, U.S. Customs and Immigration Service (USCIS) Employment Eligibility Verification I-9, Office of Personnel Management (OPM) Declaration for Federal Employment form OF-306, and Federal Bureau of Investigation (FBI) Fingerprint Card FD-258 in order to undergo a suitability background investigation which will be either a fingerprint check, a National Agency Check with Written Inquiries (NACI) or a Minimum Background Investigation (MBI).

1) If an MBI or NACI investigation is required, Contractor and subcontractor personnel will be required to complete a Standard Form 85 (SF 85), Questionnaire for Non-Sensitive Positions, or SF 85P, Questionnaire for Public Trust Positions. An SF 85 is required to be filled out for a NACI. A NACI is performed on Contractor and subcontractor personnel who are considered low risk. An SF 85P is required to be filled out for an MBI. A MBI is normally conducted for Contractor and subcontractor personnel who are in a moderate risk position or have access to Sensitive But Unclassified (SBU) information in all its forms and markings. Individuals in this category include, but are not limited to, those working as educational aides, FLETC Security Police, firearms

personnel, explosives handlers, and Information Technology (IT) specialists. In addition, the Contractor should ensure that they have completed an e-Verify search for all Foreign National (FN) Contractor and subcontractor personnel.

2) For a cleared contract, the security background check will be conducted on the Contractor (facility) and Contractor and subcontractor personnel by the Defense Industrial Security Clearance Office (DISCO).

b. The FLETC reserves the right and prerogative to deny and/or restrict facility and information access of any Contractor or subcontractor personnel whose actions are in conflict with the standards of conduct, 5 CFR 2635. In accordance with the most current version of FLETC Manual 71-01, Physical Access Control, Paragraph 6, d, (1), (a) an individual will be denied access to FLETC facilities. Examples of offenses which prevent access to the FLETC include, but are not limited to:

1) Any felony conviction within the last six years;

2) Any misdemeanor conviction of a serious nature within the last three years;

3) Multiple misdemeanor convictions within the last six years;

4) An active "habitual offender" classification for any violation of the law;

5) Any conviction for drug usage trafficking or involvement in the last two years;

6) Violence against Law Enforcement Officers (LEO);

7) Disdain of legal authority;

8) Violations of moral turpitude (e.g., child brutality, child molestation, rape, wrongful death of another, etc.);

9) Other crimes of violence;

10) An active arrest warrant for any of the aforementioned crimes, and/or;

11) Past incidents that would reflect badly on the FLETC in the eyes of the public or that would otherwise pose a threat to the safety and security of FLETC personnel or property.

c. The Contractor shall report to the CSO any adverse information coming to their attention concerning Contractor and subcontractor personnel during the course of the contract. The report shall include the individual's name and social security number. If this information results in the subsequent termination of the individual's access to the FLETC, it does not obviate the requirement to submit this report.

d. Costs, delays and other hardships that result from Contractor or subcontractor personnel being denied access to the FLETC shall be borne entirely by the Contractor. Denial of access for Contractor or subcontractor personnel to the FLETC by the CSO shall not be subject to the Contract Disputes clause and cannot be the basis for any claim under the contract. FLETC security regulations regarding physical security access

are found in the most recent revisions of the following FLETC Directives and Manuals: Number 71-01, Physical Access Control; Number 71.00B, Identification Badges, Credentials and Shields; and Number 71-11, Building/Area Security and Access.

H.29.2 Access to FLETC Facilities by Contractor Personnel

Determination of Contractor and subcontractor personnel's physical security access requirements must be coordinated with the CO or COR. Contractor and subcontractor personnel are subject to specific access requirements as defined herein.

1) Contractor. The Contractor shall manage the submission of personnel requests for background investigations, and shall conduct their own pre-screening to ensure not only that the application is complete, but also to pre-screen for suitability using the same standards the Government applies. These screening items include:

a) Public record criminal checks

b) Past Employment History

c) Education

d) Bankruptcies, Liens, Judgments

e) Verify Social Security Number (SSN), Date of Birth (DOB), and Residence

f) E-Verify name check (foreign born)

g) Google Query

h) Social Network Query

2) Suitability for Contractor Personnel to Perform on the FLETC. Suitability factors are identified in the most current version of DHS Instruction Handbook 121-01-007, Suitability and Security Program. The Contractor shall:

a) Furnish to prospective Contractor and subcontractor personnel under this contract the necessary forms to be completed to request access to the FLETC (Form I-9, OF 306, and FTC-SEM-17).

b) Review the completed forms for completeness and accuracy and submit completed forms to the CO or COR for processing.

c) Ensure that personnel have been checked through E-Verify.

i) E-Verify informational brochure on how to create an account: http://www.uscis.gov/USCIS/Verification/E-Verify/Publications/Guides/guide-enrollment.pdf

ii) E-Verify login at: https://e-verify.uscis.gov/emp/vislogin.aspx

iii) Ensure that proposed Contractor and subcontractor personnel meet the standards as outlined in the preceding paragraphs.

iv) Ensure that personnel who are moderate risk and require an MBI do not exceed the DHS bad debt limit of $7,500.00.

d) Cleared Contractors. Contractor and subcontractor personnel that are to perform on the FLETC in a national security position as identified by the FLETC CSO must be cleared personnel who have received their clearance from the DISCO. Both the Contractor (facility) and the Contractor's (to include subcontractor) personnel must have clearances issued by the DISCO.

3) Contractor Personnel Access For More Than Six Months. All Contractor and subcontractor personnel who are not temporary or intermittent and who work at the FLETC on a regular basis for more than six (6) months will be required to complete an SF 85. For Contractor and subcontractor personnel determined to be in a moderate risk position, the SF 85P will be required to be completed. Questionnaires must be completed by Contractor and subcontractor personnel utilizing the Office of Personnel Management's (OPM) Electronic Questionnaires for Investigation Processing (e-QIP) System.

a) The Security and Emergency Management Division (SEM) / Personnel Security Program (SEM/PER) will initiate Contractor and subcontractor personnel into the e-QIP system using information provided on the FTC-SEM-17.

b) Contractor and subcontractor personnel will then receive an e-mail message that provides information on accessing the OPM website and completing the electronic questionnaire.

c) In order for Contractor and subcontractor personnel to begin work, the SF 85/85P must be completed and electronically released to SEM/PER. SEM/PER will then release the SF 85/85P to the OPM for the background investigation.

d) For positions identified by the CSO or FLETC Information System Security Manager (ISSM) as low, moderate, or high risk for suitability for employment, the Contractor shall:

i) Provide to the CO a Form I-9, OF 306, and Badge Application FTC-SEM-17 for all identified Contractor and subcontractor personnel. All forms must be completed in their entirety. For U.S. Citizens, the Contractor must submit the required forms at least 10 days in advance of Contractor and subcontractor personnel's earliest proposed access to FLETC IT systems or facilities. Requirements specific to non-U.S. Citizens are outlined later in this section.

ii) Upon notification from the FLETC Security staff, Contractor and subcontractor personnel will be required to appear in person before an authorized FLETC representative for the purpose of verifying the individual's identity in accordance with Homeland Security Presidential Directive (HSPD) 12, Policy for a Common Identification Standard for Federal Employees and Contractors. HSPD-12 mandates that verification

of identification for Contractor and subcontractor personnel requires the individual to be physically present, and to present to the badging authority:

i. A picture identification card issued by either a governmental entity of one of the several States or the United States Federal government, and;

ii. One other form of identification specified on Form I-9. Upon verifying the Contractor and subcontractor personnel's identity, Contractor and subcontractor personnel shall provide fingerprints and a photograph.

iii. Following a favorably adjudicated background investigation, the FLETC may issue a Personal Identity Verification (PIV) Card to Contractor and subcontractor personnel that will enable appropriate access to the facility and IT systems. Such access will only be issued in accordance with FLETC Physical Security, Information Security and IT Security policies. Access to national security information only occurs in the event that the Contractor has received a clearance from the DISCO.

iv. At the discretion of the CSO and following the receipt of favorable National Agency Check (NAC), the FLETC may elect to approve temporary access to the facility for Contractor and subcontractor personnel while the rest of the suitability investigation is being completed. If the NAC is not returned in five (5) days from the time that the SEM/PER releases the electronic questionnaire to the OPM, the results of a fingerprint check can be used to allow the Contractor and subcontractor personnel to begin working.

4) Contractor Personnel Less Than Six Months, More Than Five Days. Contractor and subcontractor personnel who will require access to the FLETC for more than five (5) days, but less than six (6) months, the Contractor shall provide a completed OF 306, Form I-9 and Badge Application FTC-SEM-17 (Sections A and B of FTC-SEM-17 must be completed in their entirety). For U.S. Citizens, FLETC requires that the FTC-SEM-17 shall be submitted to the CO a minimum of 10 business days in advance of Contractor and subcontractor personnel's first day of needed access.

a) FLETC shall conduct background checks for access using the information provided in Sections A and B of FTC-SEM-17.

i) Upon notification from the FLETC Security staff, Contractor and subcontractor personnel will be required to appear in person before an authorized FLETC representative for the purpose of verifying the individual's identity. Verification of the Contractor and subcontractor personnel's identity requires the individual to be physically present, and to present to the badging authority:

i. A picture identification card issued by either a governmental entity of one of the several States or the United States Federal government, and;

ii. One other form of identification specified on Form I-9. Upon verifying the Contractor and subcontractor personnel's identity, Contractor and subcontractor personnel shall provide fingerprints and a photograph.

iii. Once the results of the fingerprints are received by the SEM/PER are successfully adjudicated, the Contractor will be allowed to begin work.

5) Contractor Personnel for Five Days or Less. For Contractor and subcontractor personnel who will require access to the FLETC for up to five (5) days, the Contractor shall request temporary or intermittent access utilizing FTC-SEM-17. Such access is granted at the discretion of the CSO.

6) Employment and Prime Contractor Requirements for Non-U.S. Citizens. The Contractor will adhere to the following requirements when attempting to employ Non-U.S. Citizens on the FLETC.

a) Employment requests for Foreign Nationals (FN) must be submitted to the SEM with full and complete documentation in the below identified time frame(s). Requests must be made on FTC-SEM-17, which can be obtained from the FLETC Registration Buildings/Visitors Centers at all FLETC sites.

i) NOTE: All FNs seeking to perform at the FLETC MUST present valid identification documents (i.e., Resident Alien card, Permanent Resident card, Passport, Visa, Employment Authorization Card, etc.) at the Registration Building/Visitor Center. Failure to present required credentials will result in denial of employment eligibility.

b) For FNs who are Lawful Permanent Residents (LPRs) of the United States, requests must be submitted to the SEM no less than 10 business days in advance of the first day of access. A copy of the FN's LPR card must be attached.

c) Requests for permission to work for FNs who are not LPRs, must be submitted to SEM no less than 30 business days in advance of the first day of access. A copy of the FN¿s passport (and visa, if applicable) must be attached.

d) The Contractor must notify the responsible CO as to whether they will employ any Non-U.S. Citizen Contractor or subcontractor personnel that fall into positions/areas with possible access to SBU information. SBU information includes but is not limited to: For Official Use Only (FOUO) information, Law Enforcement Sensitive (LES) information, and Sensitive Personally Identifiable Information (Sensitive PII). All new-hire FN/LPR Contractor and subcontractor personnel/applicants whose new position would fall into assignments with possible access to SBU, will be required to wait until completion of the investigation and adjudication of the contract personnel before being approved for work/access. Such notification will be in writing and will include the name(s) of all of the Contractor and subcontractor's FN/LPR Contractor and subcontractor personnel subject to these requirements. The document will state that the Contractor, subcontractor and their personnel are willing to meet the specific criteria outlined below:

i. Confirm in writing that the FN Contractor and subcontractor personnel has been an LPR of the U.S. for two (2) years or more or if non-LPR the Contractor must confirm in writing that FN personnel have a valid Employment Authorization Document, Form I-766.

ii. Confirm in writing that the Contractor believes that the FN Contractor and subcontractor personnel are not a threat to the U.S. and would properly protect and/or handle the SBU information they will be required to work with or near.

iii. Confirm in writing that the FN Contractor and subcontractor personnel have indicated that they are willing to submit to the OPM-conducted MBI and have agreed to complete the SF 85P, Form I-9, submit a set of fingerprints; and provide any additional information as needed for the conduct of the MBI.

iv. The cost of the investigation and adjudication shall be responsibility of the FN Contractor and subcontractor personnel or the Contractor.

v. FN Contractor and subcontractor personnel who are temporary/intermittent and who have work-related, or may have inadvertent, access to SBU information are required to have a successfully adjudicated MBI prior to beginning work.

vi. Access for those FN/LPR Contractor and subcontractor personnel in these kinds of positions that are not included in the Contractor's request document will be immediately rescinded.

vii. When a FN/LPR contract position applicant is being sponsored by a FLETC Partner Organization (PO) for a position with access to SBU information, the PO must conduct the required background investigations and the PO sponsor must indicate on the FTC-SEM-17 that the FN/LPR personnel/applicant has had a favorably adjudicated MBI.

H.29.3 Identification Badges and Vehicle Passes

a. All individuals working on or requesting access to the FLETC must obtain authorization to enter the FLETC through the issuance of an appropriate FLETC identification badge or PIV card. The FLETC badge/card or PIV card are required to be worn visibly on the outside clothing between the neck and waist displaying the photograph side of the identification badge at all times while on the FLETC premises. Lost or stolen identification documents must be immediately reported to the SEM Physical Security Program (SEM/PHY). Contractor and subcontractor personnel who have undergone a background investigation conducted by the OPM (NACI or MBI) and successfully adjudicated by the SEM/PER will be issued a PIV identification card. All Contractor and subcontractor personnel who have not undergone a background investigation conducted by the OPM will be issued a FLETC identification badge/card.

b. Vehicle passes are issued by the FLETC to those who need to operate and or park vehicles on FLETC property. Vehicle passes will only be issued to Contractor and subcontractor personnel for vehicles maintained in a safe operating condition. Those seeking to park or operate vehicles on the FLETC shall provide the following documents to the appropriate FLETC Security Office as directed in order to be issued a FLETC vehicle pass: Valid Driver's License; Valid Vehicle Registration Certificate; Proof of Insurance; and FLETC Identification Badge.

c. A $15.00 replacement charge will be assessed against the Contractor for each FLETC badge/card or pass that must be replaced for other than excessive wear, name

change, or other reason approved by the SEM. The replacement charge for a PIV card is $25.00. Lost or stolen identification documents shall be considered to be within the control of Contractor and subcontractor personnel. Replacement charges will be assessed and paid by the Contractor prior to the replacement identification badge being issued.

d. If Contractor and subcontractor personnel resign, are terminated, or denied access to the FLETC, voluntarily or otherwise, prior to contract completion, the bearer of the FLETC identification badge or PIV card and vehicle pass shall immediately surrender them to the Contractor. The Contractor shall return the FLETC identification badge/PIV card vehicle pass to the SEM/PHY within three (3) business days of the resignation, termination, or access denial. Failure to return the FLETC identification badge or PIV card will result in the Contractor being charged as proscribed in paragraph c. above.

H.29.4 Completion of the Contract

a. The Contractor shall be responsible for returning to the SEM all identification badges and vehicle passes issued under the contract no later than 15 days after the final acceptance of the work by the FLETC. Final contract payment shall not be authorized until the FLETC has received all identification badges and passes which have been issued under this contract, including those issued to subcontractors. If the Contractor is unable to return all badges and passes issued, a charge for the missing documents will be assessed against the final payment as per the replacement costs described above.

b. Before final payment is made, the CO in conjunction with the SEM may review the number of badge applications submitted under this contract. If the number of Contractor and subcontractor personnel denied access to the FLETC because of the results of the background investigation exceed 8% of the total number of Contractor and subcontractor personnel requesting access to the FLETC, the Contractor shall bear the cost for the background investigations for each denied background check above 8%. The cost of a basic suitability investigation is $125.00 and the cost of a moderate risk background investigation, Minimum Background Investigation, is $752.00. The percentage to be borne by the Contractor for Contractor and subcontractor personnel denied access to the FLETC because of the results of the background investigation will be across the board for each type of investigation required above the 8%. The amount will be deducted from the contract total. The amount deducted from the contract total because of this action shall not be subject to the Contract Disputes clause and cannot be the basis for any claim under the contract.

H.29.5 Review of Access and Suitability Determinations

a. Access Determinations. Access to classified national security information and the receipt of a security clearance will be in accordance with Executive Order (EO) 13526, as well as all applicable Department of Homeland Security Directives and all applicable FLETC Directives and Manuals. After contract award, Contractor and subcontractor personnel who are denied access to the FLETC shall be provided with "due process" for the denial of access in accordance with all applicable standards. All these actions will be conducted by the DISCO.

b. Suitability Determinations. When adverse information is developed in the course of a suitability investigation, the scope of the inquiry will normally be expanded to the extent necessary to obtain such additional information as may be required to determine whether Contractor and subcontractor personnel may be granted unescorted access to FLETC facilities and sensitive information. Contractor and subcontractor personnel for whom unfavorable or derogatory information has been developed shall be provided with a Proposed Action Letter (PAL) that contains the questionable information. Contractor and subcontractor personnel shall be offered the opportunity to respond to the PAL in order to refute, explain, clarify, or mitigate the information in question. If a determination of ineligibility is made, Contractor and subcontractor personnel shall be formally notified and informed of the reason(s). Adverse information about the Contractor and subcontractor personnel may not be disclosed to the Contractor and/or subcontractor. When a final determination has been made, the Contractor shall be informed simultaneously with notification to the affected individual that individual is ineligible to render services or otherwise perform under the contract. Waivers for specific requirements for working in Federal, Department of Homeland Security, and FLETC facilities shall only be granted under specific conditions and processes as defined in the applicable regulations and directions regarding such requirements.

H.30 SECURITY TRAINING

a. General. All Contractor personnel (including subcontractors or any representative of the Contractor) entering the Federal Law Enforcement Training Center (FLETC) shall be provided Security training prior to performing on FLETC. Training material will be provided by the Government.

b. Training. Security training shall be provided by the Contractor, at least annually, for Contractor and subcontractor personnel, and applicable representatives requiring access to FLETC. The training shall consist of the viewing of a Government-provided video (Security Orientation for Contractors) or review of Government-provided material contained at Section J, outlining the major security references and requirements for the Contractor.

1) All Contractor and subcontractor personnel requiring access to the FLETC shall review the Government-provided material at Section J. Contractor supervisory personnel will ensure that the Exhibit is available for review by any contractor employee.

a) Contractor and subcontractor personnel requiring access to FLETC for a period of six (6) months or more shall also view the Government-provided Security Orientation for Contractors Video at the required reporting timeframes specified below.

b) Contractor and subcontractor personnel requiring access for less than six (6) months shall review the Government-provided material at Section J.

c) Reporting. The Contractor shall deliver to the CO a Security Training List within the first 30 days of performance, and semi-annually on the first day of October and April. The Security Training List shall be provided in Microsoft Excel format, and include -

Company Name, Contract Number, Employee Name, Date Employee Reports On Center, and Date of Training. The standardized format is contained at Section J.

2) Certification. The Contractor shall certify information submitted on the Security Training List is accurate. The Contractor shall designate an authorized representative for certification purposes.

H.31 ACCESS TO UNCLASSIFIED FACILITIES, INFORMATION TECHNOLOGY RESOURCES, AND SENSITIVE INFORMATION REQUIREMENT (JUL 2013)

The assurance of the security of unclassified facilities, IT resources, and sensitive information during the acquisition process and contract performance are essential to the DHS mission. DHS Directive 11042.1, Safeguarding Sensitive But Unclassified (For Official Use Only) Information, describes how Contractors must handle sensitive but unclassified information. The DHS Sensitive Systems Handbook prescribes policies and procedures on security for IT resources. The Contractor shall comply with these policies and procedures, any replacement publications, or any other current or future DHS policies and procedures covering Contractors specifically for all task orders that require access to DHS facilities, IT resources or sensitive information. The Contractor shall not use or redistribute any DHS information processed, stored, or transmitted by the Contractor except as specified in the task order.

The Government will provide the Contractor with access to existing system.

Sensitive Information, means any information, the loss, misuse, disclosure, or unauthorized access to or modification of which could adversely affect the national or homeland security interest, or the conduct of Federal programs, or the privacy to which individuals are entitled under Section 552a of Title 5, United States Code (the Privacy Act), but which has not been specifically authorized under criteria established by an EO or an Act of Congress to be kept secret in the interest of national defense, homeland security or foreign policy. This definition includes but is not limited to the following categories of information:

(1) Protected Critical Infrastructure Information (PCII) as set out in the Critical Infrastructure Information Act of 2002 (Title II, Subtitle B, of the Homeland Security Act, Public Law 107-296, 196 Stat. 2135), as amended, the implementing regulations thereto (Title 6, Code of Federal Regulations, Part 29) as amended, the applicable PCII Procedures Manual, as amended, and any supplementary guidance officially communicated by an authorized official of the Department of Homeland Security (including the PCII Program Manager or his/her designee);

(2) Sensitive Security Information (SSI), as defined in Title 49, Code of Federal Regulations, Part 1520, as amended, "Policies and Procedures of Safeguarding and Control of SSI," as amended, and any supplementary guidance officially communicated by an authorized official of the Department of Homeland Security (including the Assistant Secretary for the Transportation Security Administration or his/her designee);

(3) Information designated as FOUO, which is unclassified information of a sensitive nature and the unauthorized disclosure of which could adversely impact a person's

privacy or welfare, the conduct of Federal programs, or other programs or operations essential to the national or homeland security interest; and

NOTE: By Fiscal Year 2014, the designation "Controlled Unclassified Information" (CUI) will replace FOUO and other sensitive but unclassified markings. As mandatory implementation time comes closer, the Contractor may find more documents, materials, and other information formats marked or referred to as CUI. Any material referenced in any manner as CUI will receive the same protections as those outlined in DHS Directive 11042.1, Safeguarding Sensitive But Unclassified (For Official Use Only) Information.

(4) Any information that is designated "sensitive" or subject to other controls, safeguards or protections in accordance with subsequently adopted homeland security information handling procedures.

(5) "Information Technology Resources" include, but are not limited to, computer equipment, networking equipment, telecommunications equipment, cabling, network drives, computer drives, network software, computer software, software programs, intranet sites, and internet sites.

Contractor and subcontractor personnel working on this contract must complete such forms as may be necessary for security or other reasons, including the conduct of background investigations to determine suitability. Completed forms shall be submitted as directed by the CO. Upon the CO's request, the Contractor and subcontractor personnel shall be fingerprinted, or subject to other investigations as required. All Contractor and subcontractor personnel requiring recurring access to Government facilities or access to sensitive information or IT resources are required to have a favorably adjudicated background investigation prior to commencing work on this contract unless this requirement is waived under Departmental procedures.

The CO may require the Contractor to prohibit individuals from working on the contract if the government deems their initial or continued employment contrary to the public interest for any reason, including, but not limited to, carelessness, insubordination, incompetence, or security concerns.

Work under this contract may involve access to sensitive information. Therefore, the Contractor shall not disclose, orally or in writing, any sensitive information to any person unless authorized in writing by the CO. For Contractor and subcontractor personnel authorized access to sensitive information, the Contractor shall ensure that these persons receive training concerning the protection and disclosure of sensitive information both during and after contract performance.

The Contractor shall include the substance of this clause in all subcontracts at any tier where the subcontractor may have access to Government facilities, sensitive information, or resources.

Before receiving access to IT resources under this contract the individual must receive a security briefing, which the COR will arrange, and complete the Contractor's verification of Security Training.

H.32 OPERATIONS SECURITY (OPSEC) REQUIREMENTS (JUL 2013)

The FLETC OPSEC Program (SEM/OPS) acts to secure against the inadvertent release or unauthorized disclosure of such information outside established control procedures. Specific, unclassified facts about the FLETC's mission, intentions, capabilities, or activities are considered critical information and must be protected to ensure our adversaries are not successful. OPSEC measures pertaining to a contract require additional requirements to consider such as:

a. FLETC must determine if there is critical information associated with the contract or activities involved in the contract that warrants the inclusion of OPSEC requirements. Consideration shall be given to the type of work being performed and the environment and circumstances in which contract performance will occur. Potential Critical Information that must be protected includes but is not limited to:

1) Indications of when and where activities will occur (such as tests) which can possibly be targeted and present collection opportunities by foreign intelligence.

2) The duration of a contract and indications of results (such as in ads, status reports and brochures).

3) The existence of a contract, services involved and what is being developed in U.S. press releases, stock prospective, etc.

4) Pictures indicating classified design features or approaches.

5) The lettering of contracts and identity of subcontractors.

6) Maps, Aerial Photographs, Floor Plans of the project.

7) Photographs including facial images.

8) Official and Personal websites (including social networking sites) revealing details of the project.

9) Contract specifications detailing how project and contractor personnel are handling/protecting SBU information.

b. To ensure uniformity in the way OPSEC requirements are presented to industry, the following guidance shall be followed:

1) Guidance will be appended to basic solicitations or contracts and labeled "OPSEC Requirements."

2) OPSEC guidance will include Critical Information pertinent to contractual activities and essential secrecy to be maintained and statement of harm if adversaries derive accurate estimates.

c. If OPSEC requirements are necessary, an OPSEC review shall be conducted of the statement of work (SOW) for contracts prior to the time the CO releases the SOW to contract offerors/bidders. The SOW is a publicly released document that can reveal

critical information or indicators of critical information. It is important that COs, CORs and Contractors work with SEM/OPS and project coordinators, e.g., FLETC Facilities Management Division (FMD), PRO, etc. to identify OPSEC requirements for the scope of work to be performed. The SOW should also undergo a formal content review prior to its release to the public.

d. FLETC and PO COs, CORs, and contractor managers are responsible for ensuring that their respective Contractors are aware of this policy and adhere to these requirements. This includes responding to Contractor inquiries on what photography is permissible and what is not, as well as researching and coordinating interpretation of the policy with SEM/OPS.

e. Contractor and subcontractor personnel may be required to participate in formal OPSEC classroom and/or computer based training (CBT) and briefings, as required.

f. Contractor and subcontractor personnel use of personal still and video photography (including cell phone cameras) is prohibited.

g. Contractor and subcontractor personnel use of still and video photography is limited to ONLY those authorized activities on FLETC facilities that have been approved by the applicable FLETC Training Directorate and/or PO Academy, are part of official visits and media activities coordinated through the FLETC Public Affairs Office (PAO), and/or are part of contract requirements coordinated through the respective CO, COR, and SEM/OPS.

h. Photographing of ANY training activity must be approved in writing by the applicable FLETC Training Directorate and/or PO Academy.

1) Contractor and subcontractor personnel to whom access to FLETC-related SBU and critical information is granted will:

2) Be aware of and comply with FLETC safeguarding requirements for OPSEC, as applicable.

3) Be aware that not protecting DHS and FLETC critical information may result in administrative or disciplinary action.

4) Participate in formal OPSEC classroom and/or CBT and briefings, as required.

5) The Contractor will coordinate with Project Coordinators, e.g., FMD, and SEM/OPS the conduct of OPSEC reviews, assessments, and evaluations of FLETC contractor products designated for external distribution or publication to include television, radio, film, video, print, photography, and electronic products, for those assigned contracts.

a) As applicable, the Contractor will ensure that all subordinate Contractor and subcontractor personnel will participate with these reviews, surveys, assessments, development of countermeasures, etc., for their respective organization.

b) The Contractor will ensure documentation of individual Contractor and subcontractor personnel attendance at OPSEC briefings and training occurs by following established

training documentation procedures, as applicable. Submit all applicable Contractor OPSEC training documentation to the respective COR.

H.33 INFORMATION TECHNOLOGY AND DATA SECURITY REQUIREMENTS (JUL 2013)

a. General Requirements: All Contractor and subcontractor personnel in the performance of this contract requiring access to the FLETC information technology (IT) systems or sensitive data shall abide by all FLETC IT security regulations which may be in effect during the contract period. Any such individual(s) shall be subject to those checks which may be deemed necessary by the FLETC to ensure that no violations occur. It shall be the Contractor's responsibility to ensure that all Contractor and subcontractor personnel who are expected to have access to FLETC-owned or -operated IT systems or IT systems contracted on behalf of the FLETC that contain FLETC sensitive data or information, undergo or have undergone an appropriate suitability background investigation. The type of background investigation that is conducted is based on the FLETC's assessment of risk of the contractor's position. Positions may be categorized as either IT or non-IT and based on the risk (i.e., low, moderate) to public trust.

Determination of Contractor and subcontractor personnel IT access needs must be coordinated with the COR. IT system and data suitability background investigation requirements may be greater than those requirements for physical security access to the FLETC facilities. Suitability background investigation processes for physical security access will be followed as contained in this Section H. Temporary IT system and data access will only be permitted for non-sensitive IT systems and data. For Contractor and subcontractor personnel who will require admittance to FLETC facilities and/or are being given access to FLETC SBU information that includes, Personnel Identity Information (PII), Protected critical Infrastructure Information (PCII), Sensitive Security Information (SSI), FOUO, or IT resources, will be required to undergo a background investigation even if they work for less than six months. Depending on the risk level, the background investigation will be a NACI or MBI. The risk determination will be made in consultation with the CO, PHY, PER, and the Chief Information Security Officer (CISO).

The required suitability background investigation forms will be provided upon contract award. All forms must be completed in their entirety by all Contractor and subcontractor personnel subject to the requirement. If the background investigation results in an unfavorable adjudication, the individual will be denied access to FLETC IT systems and sensitive data. Examples of offenses which could prevent access to FLETC IT systems and sensitive data include, but are not limited to: any felony convictions or habitual violations, any crimes against a police officer, any conviction for distribution of illegal drugs, or any crimes of moral turpitude. Any cost or time delay which the Contractor experiences in the contract due to Contractor and subcontractor personnel being denied access to FLETC IT systems and sensitive data shall be the sole responsibility of the Contractor. Denial of IT system access for any individual because of failure to meet FLETC IT security standards shall not be subject to the Contract Disputes clause and cannot be the basis for any claim under the contract. The DHS IT security requirements are outlined in DHS Sensitive Systems Policy Directive 4300A.

b. Contract Completion: The Contractor shall be responsible for ensuring the FLETC Chief Information Officer (CIO) Directorate is notified of all Contractor and subcontractor personnel released from this contract support at the time of release, voluntarily or otherwise and at the end of the contract, who were issued access accounts to any FLETC IT systems. Notification to the CIO Directorate shall be through the COR.

H.33.1 Information Technology Security Training

a. All Contractor and subcontractor personnel entering the FLETC shall be provided IT Security training prior to accessing an information system, its information, and resources. Training material will be provided by the Government. 5 CFR part 930, subpart C, as revised, requires that all users of Federal information systems be exposed to security awareness materials annually or whenever system security changes occur, or when the user's responsibilities change. Training for new system users must occur before they are allowed access to systems. OMB Circular A-130, Appendix III, Security of Federal Automated Information Resources, requires that persons be trained in their responsibilities and in the Rules of Behavior for system. In accordance with FLETC policy, all IT system users must complete initial IT security training and must acknowledge the FLETC IT system rules of behavior, prior to gaining system access.

b. IT Security Awareness training shall be provided by the Contractor for Contractor and subcontractor personnel requiring access to FLETC IT systems and resources. The Contractor shall use training prescribed by the Chief Information Security Officer. Contractor and subcontractor personnel must receive the prescribed training before initial access will be granted, and annually thereafter until access is no longer required.

c. The Contractor shall deliver to the CO an IT Security training report within the first 30 days of performance. The report shall be provided in Microsoft Excel format. The report shall contain the Company Name, Employee Name, Date, and Date of Training.

d. The Contractor shall verify information submitted on the report is accurate.

e. In addition to IT Security Awareness training, the Contractor shall provide Contractor and subcontractor personnel performing significant IT security responsibilities under this contract with specific role-based training prescribed in Appendix A of the FLETC IT Security Awareness, Training and Education Plan.

H.33.2 IT Access

The Contractor shall sign the prescribed Rules of Behavior before access to FLETC IT systems will be granted. The Contractor consents to monitoring for compliance and other lawful purposes while using a FLETC-issued account.

H.33.3 Contractor IT Security Plan

The Contractor shall provide, implement and maintain an IT Security Plan. The plan shall be delivered to the CO in accordance with HSAR 3052.204-70, Security Requirements for Unclassified Information Technology Resources for Government

approval. Upon Government approval the plan will be incorporated into the contract as a compliance document.

H.33.4 Interconnection Security Agreements

Interconnections between FLETC and non-FLETC IT systems shall be established only through controlled interfaces and via approved service providers. The controlled interfaces shall be accredited at the highest security level of information on the network. Connections with other Federal agencies shall be documented based on interagency agreements; memoranda of understanding, service level agreements or interconnection security agreements.

H.33.5 Information Security Standards Applicable to this Contract

DHS Sensitive Systems Policy Directive 4300A, version 9.0.2, March 2012, or subsequent publication.

H.34 PHASE-IN/ORIENTATION PERIOD (JUL 2013)

a. The Contractor shall become acquainted with all available information regarding difficulties which may be encountered and the conditions under which the work of this contract must be accomplished. The Contractor will NOT be relieved from assuming all responsibility for properly estimating the difficulties and the cost of performing the services required because of his failure to investigate the conditions or to become acquainted with all information concerning the services to be performed.

b. The Contractor shall begin phase-in only after post award conference and in accordance with the requirements contained in the submitted phase-in plan. The Contractor is expected to be at full performance at the completion of the phase-in period.

c. The Contractor shall begin an orientation to:

1) Become thoroughly familiar with work requirements and work procedures.

2) Finalize development of necessary work plans and procedures.

3) Complete personnel requirements (work force) including the hiring of personnel to assure satisfactory performance beginning on the contract start date.

4) Obtain security clearances, if required.

5) Complete training requirements and accomplish necessary training of Contractor and subcontractor personnel.

6) Finalize the development of quality control plans and procedures.

7) The Contractor is prohibited from soliciting Government personnel for employment.

d. Immediately after award and prior to performance, the Contractor's representative and the COR shall make an on-site, in-depth review of the total job requirements. The

Contractor will be allowed access to the facilities to familiarize supervisors, key personnel, and staff with equipment, reporting, work scheduling and procedures (including operations, priorities, safety, security, etc). To preclude interference with work production efforts of the current personnel, arrangements for access to Government facilities will be made with the CO.

e. The Contractor shall make provisions for all required building, material, and equipment inventories to be conducted during the last 10 business days of the phase-in period. The Contractor shall coordinate these inventories with the COR so those appropriate representatives may be present for all inventories. The Contractor shall sign receipt for the items upon completion of the inventory. Responsibility for performance of the services covered shall also pass to the Contractor at that time. A proposed schedule for the inventories shall be included in the phase-in plan.

H.35 PHASE-OUT/CONTRACT COMPLETION (JUL 2013)

a. The Contractor shall schedule any and all inventories to occur within 15 business days prior to exercise of options or the termination of the contract. The Contractor shall coordinate these inventories with the COR so those appropriate representatives may be present.

b. Within five (5) business days after completion of this contract (or as otherwise directed by the CO) the Contractor shall remove all Contractor owned vehicles, equipment, tools, supplies, materials, or other items from the FLETC. The Government reserves the right to dispose of items remaining after the stated period in accordance with Federal property regulations.

c. Within 21 business days after completion of this contract the Contractor shall return all personnel identification badges. Final contract payment will not be authorized until the FLETC has received all identification badges and passes issued under this contract.

d. All documents will be maintained in an organized, acceptable working order by the Contractor in the Government provided office. The Technical Library, if required by this contract, shall remain in place, in acceptable working order, at the Contractor's office at completion (or termination) of the contract. Upon contract completion or termination of the contract the Contractor shall make the library available to the follow-on contractor during the Phase in/Phase out period. The exiting Contractor shall ensure the Technical Library is in an organized and maintained state prior to turning over to the follow-on contractor.

H.36 SALVAGE

All Government-owned material and equipment which are removed or disconnected, but are not specifically indicated or specified for reuse shall remain the property of the Government if determined by the COR to be of value. Such items shall be delivered by the Contractor to the location on FLETC designated by the CO, when and if circumstances arise which warrant doing so.

H.37 CONTRACTOR INGRESS/EGRESS

a. The Contractor is required to use the gate as instructed by COR for employees and material deliveries. The Government may direct the Contractor to construct a contractor entry point outside the FLETC property for trucks and movement of equipment.

b. Contractor vehicles entering the Center will be required to show proof of insurance as specified in this Section H.

H.38 SUBCONTRACTING REQUIREMENTS

a. In accordance with FAR clause 52.222-11, Subcontracts (Labor Standards and Acknowledgement (Section J) the Contractor or Subcontractor shall ensure that all terms and conditions of this contract are incorporated into any and all subcontracts issued in the performance of this contract. The clauses to be incorporated into any subcontract include the following:

Davis-Bacon Act
Apprentices and Trainees
Payrolls and Basic Records
Compliance with Copeland Act Requirements
Withholding of Funds
Subcontracts (Labor Standards)
Contract Termination – Debarment
Disputes Concerning Labor Standards
Compliance with Davis-Bacon and Related Act Regulations
Certification of Eligibility

b. Qualifications of the Subcontractor(s), the scheduled period of execution for the respective trade(s), and the delivery of the requested materials for each trade shall be submitted by the Contractor to the CO at least two (2) weeks prior to the commencement of work under that trade.

c. The Contractor shall ensure that Subcontractor(s) attend progress meetings held during the performance of the Subcontractor's trade. The Contractor is responsible for all coordination and scheduling with the Subcontractor(s) regarding work under this contract. The Contractor is responsible for the work of the Subcontractor and if work of the Subcontractor is not acceptable to the Government under the terms of the contract, the Contractor shall be responsible for making the work acceptable, including any additional costs or time involved.

H.39 PRECONSTRUCTION CONFERENCE

a. A preconstruction conference will be arranged by the CO after award of contract and before the Notice to Proceed is issued. The CO/Specialist will notify the Contractor of the time and date set for the meeting. At this conference the Contractor shall be oriented with respect to Government procedures and line of authority, contractual, administrative (security, fire and environment protection), safety, labor, and construction

responsibilities. The Contractor will have the opportunity at the conference to ask questions concerning any contractual requirements.

b. Prior to this conference the Contractor shall submit each of the following preconstruction submittals referenced in technical specification Section 01 33 00 “Submittal Procedures”:

Certificates of insurance
Surety bonds
Key Personnel certification and appointment letters
Accident Prevention Plan
Health and Safety Plan
Quality Control Plan
Project Schedule

c. The Contractor’s proposed Project Manager, Superintendent, and Quality Control Manager must attend the Preconstruction Conference.

d. The Safety/Accident Prevention Plan, Quality Control Plan, and, the Environmental Protection Plan, shall be submitted to the CO seven (7) days prior to the Preconstruction Conference and require Government approval prior to Notice To Proceed and work commencement on site.

e. A Letter of Record will be written documenting all items discussed at the conference, and a copy will be furnished by the Procurement Office to all in attendance.

H.40 NONCOMPLIANCE NOTICE (LEVEL 2)

a. The Contractor shall provide a Safety Representative for this contract. This individual shall be responsible for the overall safety of the project site and shall have the authority to act in all safety matters for the Contractor. The Safety Representative shall be on site at all times during construction. The Safety Officer may not be the QCM. Reference the related Safety Officer’s requirement presented in technical specification Sections 01 45 00 and 01 52 50.

b. If a Contractor is found to be in violation of safety regulations (Title 29 Code of Federal Regulation, part 1926 and 1910, and Department of Homeland Security Directive 066-01, Safety and Health Program3) or in noncompliance with various terms or specifications of the contract, a notice will be issued by the Construction Representatives or other Government personnel assigned to the contract. Receipt of this notification shall be indicated by the signature of the Contractor’s Safety Representative on the form, as well as the signature of the Contractor’s Superintendent. Potential violation or areas of noncompliance will be addressed during a preconstruction conference.

H.41 TIME EXTENSION FOR UNUSUALLY SEVERE WEATHER – GLYNCO, GEORGIA

a. This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with FAR clause 52.249-10, Default (Fixed Price Construction). Contractor shall be responsible for verification and consideration of National Oceanic and Atmospheric Administration's (NOAA) historical monthly averages for the NOAA location closest to the contract site, or similar data. In order for the CO to award a time extension under this clause, the following conditions must be satisfied:

1. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

2. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

b. Upon acknowledgment of the Notice to Proceed and continuing throughout the contract, the Contractor shall record on the daily Contractor's Quality Control (CQC) report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day.

c. The number of actual adverse weather days shall include days impacted by actual adverse weather (even if adverse weather occurred in the previous month), be calculated chronologically from the first to the last day in each month and be recorded as full days. The CO will examine any adverse weather days to determine whether a Contractor is entitled to a time extension. Adverse weather days occurring must prevent work for 50 percent or more of the Contractor's work day and delay work critical to the timely completion of the project. In order to claim adverse weather delays, the Contractor shall maintain and submit a monthly record of all actual adverse weather days. The CO will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with contract clause entitled "DEFAULT (FIXED-PRICE CONSTRUCTION (FAR 52.249-10)."

d. The Contractor's schedule must consider adverse weather delays on all weather dependent activities. The following table of anticipated adverse weather delay days reflects climatological data based on National Oceanic and Atmospheric Administration data for the project area and will constitute the baseline for the total contract time adverse weather delay evaluations. The contractor's progress schedule must anticipate this number of adverse weather delays in weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON 5-DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7	6	7	6	7	6	7	6	6	4	4	6

H.42 EQUITABLE ADJUSTMENTS; WAIVER AND RELEASE OF CLAIMS

a. Pursuant to the Changes Clause at FAR 52.243-4, the work under this contract may be changed. If a change under this clause causes an increase or decrease in the cost of, or time required for, the performance of any part of the work under this contract, whether or not changed by any such order, an equitable adjustment shall be made and the contract modified accordingly. This provision describes the process by which a Contractor must prepare and submit its request for equitable adjustment.

b. A Contractor's request for an equitable adjustment to the contract amount must be in writing. The proposal must include:

1. The date, circumstances, and source of the order to change the Work;
2. A description of the planned Work immediately prior to the changed work with regard to the Project Schedule; and,
3. Statements that the Contractor regards the order or condition to be change to the Contract that causes (or will cause) an increase or decrease in the Contractor's costs of and/or time required for performance.

c. Each request for equitable adjustment that involves a request to increase or decrease the contract amount must include a detailed quantification of the requested adjustment along with sufficient information and documentation to support the reasonableness of the proposed amount(s). This information and documentation to support changes to the cost of labor, equipment, materials, subcontracts, or other direct or indirect costs incurred (or planned to be incurred) may be submitted in the form of, but not limited to:

1. Cost or pricing data as described by FAR Part 15;
2. Unit prices charged on other recent comparable projects (for work subject to unit pricing);
3. Competitive subcontractor quotes;
4. An itemized breakdown of costs by separate trades and/or subcontractors, to include documentation of subcontractor/supplier quotes/proposals and a statement that the Contractor considers the subcontractor/supplier quote/proposal to be fair and reasonable;
5. Contractor/subcontractor/supplier mark-ups; and
6. Other costs included in the Contractor's proposal that are defined, documented and supported.

d. Detailed cost information to support or document proposed costs may include, as a minimum, the following types of information:

1. Direct labor costs to include the estimated number of hours for each trade and hourly rate of pay. There may be circumstances in which the proposal should be documented by reflecting the impact to specific positions. Documentation may include such records as certified payrolls, job cost reports, and project costs reports. (NOTE: Where the direct labor costs exceed $25,000, associated labor costs, such as Workmen's Compensation, employment taxes, FICA and FUTA should be broken out separately.)

2. Direct material costs including quantities, measurements and unit prices.

3. Construction equipment costs (if applicable) supported by equipment type and rental rate or hourly cost of ownership.

4. Overhead, profit, and/or commission as applicable.

e. Proposals, including all documentation and support, shall be submitted not later than 14 calendar days after being requested unless otherwise directed.

f. The percentages for overhead, profit, and commission which will be allowed by the Government may vary according to the nature, extent, and complexity of the work involved, but in no case shall exceed the following guidelines:

1. Percentages for commission, profit, and overhead shall be negotiated and may vary according to the nature, extent and complexity of the work involved. Only costs allowed within the principles and procedures of FAR Part 31 will be considered within costs attributable to overhead. In no case shall the commission, profit or overhead exceed the following unless the Contractor clearly demonstrates entitlement to a higher percentage:

Work Performed By:	**Maximum Potential Charges**	**Commission**	**Profit**	**O/H**
Prime Contractor's Own Workforce	Prime Contractor	None	10%	10%
Subcontractor's Workforce	Subcontractor	None	10%	10%
	Prime Contractor	8%		
Sub-Subcontractor's Workforce	Sub-Subcontractor	None	10%	10%
	Subcontractor	5%		
	Prime Contractor	5%		

2. In no instance shall the Government provide for more than three tiers or layers of profit and or commission, irrespective of the number of tiers or layers of purchase, acquisition or contracting. Neither overhead changes nor profit shall be allowed by any entity that does not directly incur costs of the work performed.

3. Equitable adjustments for deleted work shall include credits for overhead, profit and/or commission at the same level as costs would have been incurred. If a proposal includes both increases and decreases in the contract price, the application of overhead and profit shall be on the net change in direct costs to the Contractor, Subcontractor or Sub-Subcontractor performing the work.

4. Unless otherwise defined by contract terms and conditions or separate rate agreement, overhead, profit and commissions include all indirect and other direct costs of the Work. Where appropriate, the costs of bonds and insurance shall be reflected as a separate line of cost.

h. Whenever the Contractor submits a claim for equitable adjustment under any clause of this contract which provides the equitable adjustment of the contract, such claim shall include all types of adjustments in the total amounts to which the clause entitles the Contractor, including, but not limited to, adjustments arising out of delays of disruptions or both caused by such change. Except as the parties may otherwise expressly agree, the Contractor shall be deemed to have waived (i) any adjustments to which it otherwise might be entitled under the clause where such claim fails to request such adjustments, and (ii) any increase in the amount of equitable adjustments additional to those requested in its claim.

i. The Contractor agrees that, if required by the CO, he will execute a release, in form and substance satisfactory to the CO, as part of the supplemental agreement setting forth the aforesaid equitable adjustment. The Contractor further agrees that such release shall discharge the Government, its officers, agents and employees, from any further claims, including, but not limited to, further claims arising out of delays or disruptions or both caused by the aforesaid change.

H.43 PERCENTAGE OF WORK PERFORMED BY THE CONTRACTOR

Prior to commencement of the work at the site, the Contractor shall furnish to the CO a description of work to be performed with the Contractor's own organization and the percentage of total amount of work to be performed under the contract which this represents. Consider the value of materials as part of work performed by the Contractor only if the materials are to be installed on the site by his own organization.

H.44 AREA OF CONTRACT OPERATIONS

a. The Contractor shall take all precautions to ensure that no damage will result from his operations to private or public property. All damages caused by the Contractor shall be repaired or replaced by the Contractor at no cost to the Government. The Contractor shall submit a list of all of his construction machinery, equipment, and materials to be used on the site. This list shall be submitted to the CO at the Preconstruction Conference and shall include, as applicable, the following: accommodation scaffolding,

backhoe, grader, etc. The list shall provide the quantities, types of equipment, and the scheduled period of use on the site.

b. The Contractor shall store all supplies and equipment on project site so as to preclude mechanical and climatic damage. Materials and equipment shall be protected in accordance with the manufacturer's recommendations. Maintain site in a neat and orderly manner daily.

c. The Contractor shall cover equipment that is to remain in place within the area of contract operations and protect it against damage or loss. Store equipment that is removed in performance of work where directed or reuse in work as required by drawings and specifications. Equipment temporarily removed shall be protected, cleaned, and replaced equal to its condition prior to starting work. Security for equipment or material that is to be reused and is removed for temporary storage shall be the sole responsibility of the Contractor.

d. The Contractor shall comply with all applicable State and Local laws, ordinances, and regulations relative to noise control.

e. The Contractor shall ensure all trucks leaving the site with loose debris are loaded in a manner that will prevent dropping of materials on streets. Fasten suitable tarpaulins over the load before entering surrounding streets. In the event of spillage, the Contractor shall be responsible for cleanup to restore the site to the original condition and appearance.

f. The Contractor shall provide adequate toilet facilities for all Contractor personnel.

H.45 GOVERNMENT FURNISHED PROPERY (GFP)

Government furnished property, if provided, will be issued through the Facilities Management Division. The Contractor shall coordinate with the COR to schedule pick-up. Pick-up, delivery, and installation will be the responsibility of the Contractor.

H.46 RECORDING AND PRESERVING HISTORICAL AND ARCHEOLOGICAL FINDS

All items having any apparent historical or archeological interests discovered in the course of any construction activities shall be carefully preserved. The Contractor shall leave the archeological find undisturbed and immediately report the find to the CO and the COR so that proper authorities may be notified.

H.47 CONTRACTOR'S STAFF

The Contractor shall maintain sufficient off-site support staff, and competent full time staff at the Project site authorized to act on behalf of the Contractor to coordinate, inspect, and provide general direction of the work and progress of the subcontractors. Key personnel staffing requirements establish a minimum level of on-site managerial staffing required under this contract. Additional support staffing, to include clerical staff, may be necessary to support the work load.

H.48 CONSTRUCTION STAGING AREA

Prior to establishing a staging area for use during construction, the successful Offeror shall contact the CO or his duly authorized representative for direction and/or an approved site.

H.49 ACTIVE SHOOTER TRAINING (DEC 2015)

a. General. All Contractor personnel (including subcontractors or any representative of the Contractor) entering the Federal Law Enforcement Training Centers (FLETC) shall be provided Active Shooter Threat training. Training material will be provided by the Government.

b. Training. Active Shooter Threat training shall be provided by the Contractor, at least annually, for Contractor and subcontractor personnel, and applicable representatives requiring access to FLETC. The training shall consist of viewing the one (1) hour Government-provided video (Active Shooter Threat training).

1) All current contractor and subcontractor personnel requiring access to the FLETC shall view the Government-provided material at Section J within thirty (30) days. The DVD will be provided at time of award.

2) All new contractor and subcontractor personnel requiring access to FLETC shall be trained within the first thirty (30) days of reporting for duty.

c. Reporting. The Contractor shall deliver to the CO an Active Shooter Threat Training List within the first 30 days of performance, and semi-annually on the first day of October and April. The Active Shooter Threat Training List shall be provided in Microsoft Excel format, and include - Company Name, Contract Number, Employee Name, Date Employee Reports On Center, and Date of Training. The standardized format is contained at Section J.

d. Certification. The Contractor shall certify information submitted on the Active Shooter Threat Training List is accurate. The Contractor shall designate an authorized representative for certification purposes.

I - Contract Clauses

Clauses

52.202-1 Definitions. (JUN 2020)

52.203-3 Gratuities. (APR 1984)

52.203-5 Covenant Against Contingent Fees. (MAY 2014)

52.203-6 Restrictions on Subcontractor Sales to the Government. (JUN 2020)

52.203-7 Anti-Kickback Procedures. (JUN 2020)

52.203-8 Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity. (MAY 2014)

52.203-10 Price or Fee Adjustment for Illegal or Improper Activity. (MAY 2014)

52.203-12 Limitation on Payments to Influence Certain Federal Transactions. (JUN 2020)

52.203-17 Contractor Employee Whistleblower Rights (NOV 2023)

52.203-18 – Prohibition on Contracting with Entities that Require Certain Internal Confidentiality Agreements or Statements—Representation (Jan 2017)

52.203-19 Prohibition on Requiring Certain Internal Confidentiality Agreements or Statements (Jan 2017)

52.204-1 Approval of Contract. (DEC 1989)

This contract is subject to the written approval, one level above the Department of Homeland Security Contracting Officer and shall not be binding until so approved.

(End of clause)

52.204-2 Security Requirements. (MAR 2021)

52.204-9 Personal Identity Verification of Contractor Personnel. (AUG 2025)

52.204-10 Reporting Executive Compensation and First-Tier Subcontract Awards. (AUG 2025)

52.204-13 System for Award Management Maintenance. (AUG 2025)

52.204-14 Service Contract Reporting Requirements (AUG 2025)

52.204-16 Commercial and Government Entity Code Reporting (AUG 2020)

52.209-6 Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment. (NOV 2025)

52.209-9 Updates of Publicly Available Information Regarding Responsibility Matters. (NOV 2025)

52.209-10 Prohibition on Contracting With Inverted Domestic Corporations. (NOV 2025)

52.209-11 – Representation by Corporations Regarding Delinquent Tax Liability or a Felony Conviction under any Federal Law (NOV 2025)

52.210-1 Market Research. (MAY 2025)

52.211-2 Liquidated Damages-Construction (Sept 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of ***$236.53*** *f*or each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.215-2 Audit and Records - Negotiation. (OCT 2025)

52.215-8 Order of Precedence - Uniform Contract Format. (OCT 2025)

52.219-1 Small Business Program Representations.(OCT 2025)

52.219-6 Notice of Total Small Business Set-Aside. (OCT 2025)

52.219-8 Utilization of Small Business Concerns (OCT 2025)

52.219-14 Limitations on Subcontracting. (OCT 2025)

52.219-28 Post-Award Small Business Program Representation. (OCT 2025)

(a) Definitions. As used in this clause—

Long-term contract means a contract of more than five years in duration, including options. However, the term does not include contracts that exceed five years in duration because the period of performance has been extended for a cumulative period not to exceed six months under the clause at 52.217-8, Option to Extend Services, or other appropriate authority.

Small business concern—

(1) Means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in paragraph (d) of this clause. Such a concern is “not dominant in its field of operation” when it does not exercise a controlling or major influence on a national basis in a kind of business activity in which a number of business concerns are primarily engaged. In determining whether dominance exists, consideration shall be given to all appropriate factors, including volume of business, number of employees, financial resources, competitive status or position, ownership or control of materials, processes, patents, license agreements, facilities, sales territory, and nature of business activity.

(2) Affiliates, as used in this definition, means business concerns, one of whom directly or indirectly controls or has the power to control the others, or a third party or parties control or have the power to control the others. In determining whether affiliation exists, consideration is given to all appropriate factors including common ownership, common management, and contractual relationships. SBA determines affiliation based on the factors set forth at 13 CFR 121.103.

(b) If the Contractor represented that it was any of the small business concerns identified in 19.000(a)(3) prior to award of this contract, the Contractor shall rerepresent its size and socioeconomic status according to paragraph (f) of this clause or, if applicable, paragraph (h) of this clause, upon occurrence of any of the following:

(1) Within 30 days after execution of a novation agreement or within 30 days after modification of the contract to include this clause, if the novation agreement was executed prior to inclusion of this clause in the contract.

(2) Within 30 days after a merger or acquisition that does not require a novation or within 30 days after modification of the contract to include this clause, if the merger or acquisition occurred prior to inclusion of this clause in the contract.

(3) For long-term contracts-

(i) Within 60 to 120 days prior to the end of the fifth year of the contract; and

(ii) Within 60 to 120 days prior to the date specified in the contract for exercising any option thereafter.

(c) If the Contractor represented that it was any of the small business concerns identified in 19.000(a)(3) prior to award of this contract, the Contractor shall rerepresent its size and socioeconomic status according to paragraph (f) of this clause or, if applicable, paragraph (h) of this clause, when the Contracting Officer explicitly requires it for an order issued under a multiple-award contract.

(d) The Contractor shall rerepresent its size status in accordance with the size standard in effect at the time of this rerepresentation that corresponds to the North American Industry Classification System (NAICS) code(s) assigned to this contract. The small business size standard corresponding to this NAICS code(s) can be found at https://www.sba.gov/document/support--table-size-standards.

(e) The small business size standard for a Contractor providing an end item that it does not manufacture, process, or produce itself, for a contract other than a construction or service contract, is 500 employees if the acquisition—

(1) Was set aside for small business and has a value above the simplified acquisition threshold;

(2) Used the HUBZone price evaluation preference regardless of dollar value, unless the Contractor waived the price evaluation preference; or

(3) Was an 8(a), HUBZone, service-disabled veteran-owned, economically disadvantaged women-owned, or women-owned small business set-aside or sole-source award regardless of dollar value.

(f) Except as provided in paragraph (h) of this clause, the Contractor shall make the representation(s) required by paragraph (b) and (c) of this clause by validating or updating all its representations in the Representations and Certifications section of the System for Award Management (SAM) and its other data in SAM, as necessary, to ensure that they reflect the Contractor's current status. The Contractor shall notify the contracting office in writing within the timeframes specified in paragraph (b) of this clause, or with its offer for an order (see paragraph (c) of this clause), that the data have been validated or updated, and provide the date of the validation or update.

(g) If the Contractor represented that it was other than a small business concern prior to award of this contract, the Contractor may, but is not required to, take the actions required by paragraphs (f) or (h) of this clause.

(h) If the Contractor does not have representations and certifications in SAM, or does not have a representation in SAM for the NAICS code applicable to this contract, the Contractor is required to complete the following rerepresentation and submit it to the contracting office, along with the contract number and the date on which the rerepresentation was completed:

(1) The Contractor represents that it □ is, □ is not a small business concern under NAICS Code _____ assigned to contract number _____.

(2) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that it □ is, □ is not, a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that it □ is, □ is not a women-owned small business concern.

(4) Women-owned small business (WOSB) concern eligible under the WOSB Program. [Complete only if the Contractor represented itself as a women-owned small business concern in paragraph (h)(3) of this clause.] The Contractor represents that—

(i) It □ is, □ is not a WOSB concern eligible under the WOSB Program, has provided all the required documents to the WOSB Repository, and no change in circumstances or adverse decisions have been issued that affects its eligibility; and

(ii) It □ is, □ is not a joint venture that complies with the requirements of 13 CFR part 127, and the representation in paragraph (h)(4)(i) of this clause is accurate for each WOSB concern eligible under the WOSB Program participating in the joint venture. [The Contractor shall enter the name or names of the WOSB concern eligible under the WOSB Program and other small businesses that are participating in the joint venture:_____.] Each WOSB concern eligible under the WOSB Program participating in the joint venture shall submit a separate signed copy of the WOSB representation.

(5) Economically disadvantaged women-owned small business (EDWOSB) concern.[Complete only if the Contractor represented itself as a women-owned small business concern eligible under the WOSB Program in (h)(4) of this clause.] The Contractor represents that—

(i) It □ is, □ is not an EDWOSB concern eligible under the WOSB Program, has provided all the required documents to the WOSB Repository, and no change in circumstances or adverse decisions have been issued that affects its eligibility; and

(ii) It □ is, □ is not a joint venture that complies with the requirements of 13 CFR part 127, and the representation in paragraph (h)(5)(i) of this clause is accurate for each EDWOSB concern participating in the joint venture. [The Contractor shall enter the name or names of the EDWOSB concern and other small businesses that are participating in the joint venture: _____.] Each EDWOSB concern participating in the joint venture shall submit a separate signed copy of the EDWOSB representation.

(6) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that it □ is, □ is not a veteran-owned small business concern.

(7) [Complete only if the Contractor represented itself as a veteran-owned small business concern in paragraph (h)(6) of this clause.] The Contractor represents that it □ is, □ is not a service-disabled veteran-owned small business concern.

(8) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that—

(i) It □ is, □ is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material changes in ownership and control, principal office, or HUBZone employee percentage have occurred since it was certified in accordance with 13 CFR part 126; and

(ii) It □ is, □ is not a HUBZone joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (h)(8)(i) of this clause is accurate for each HUBZone small business concern participating in the HUBZone joint venture. [The Contractor shall enter the names of each of the HUBZone small business concerns participating in the HUBZone joint venture: _____.] Each HUBZone small business concern participating in the HUBZone joint venture shall submit a separate signed copy of the HUBZone representation.

[Contractor to sign and date and insert authorized signer's name and title.]

(End of clause)

52.222-1 Notice to the Government of Labor Disputes. (FEB 1997)

52.222-3 Convict Labor. (JUN 2003)

52.222-4 Contract Work Hours and Safety Standards - Overtime Compensation. (OCT 2025)

52.222-6 Construction Wage Rate Requirements. (OCT 2025)

52.222-7 Withholding of Funds. (MAY 2014)

52.222-8 Payrolls and Basic Records. (JUL 2021)

52.222-9 Apprentices and Trainees. (JUL 2005)

52.222-10 Compliance with Copeland Act Requirements. (FEB 1988)

52.222-11 Subcontracts (Labor Standards). (OCT 2025)

52.222-12 Contract Termination - Debarment. (OCT 2025)

52.222-13 Compliance With Construction Wage Rate Requirements and Related Regulations. (MAY 2014)

52.222-14 Disputes Concerning Labor Standards. (FEB 1988)

52.222-15 Certification of Eligibility. (MAY 2014)

52.222-21 Prohibition of segregated facilities. (APR 2015)

52.222-23 Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity for Construction. (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for Minority Participation for Each Trade

22.2%

Goals for Female Participation for Each Trade

6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the-

(1) Name, address, and telephone number of the subcontractor;

(2) Employer's identification number of the subcontractor;

(3) Estimated dollar amount of the subcontract;

(4) Estimated starting and completion dates of the subcontract; and

(5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is the Federal Law Enforcement Training Center, Glynco, GA.

(End of provision)

52.222-26 Equal Opportunity. (Sep 2016)

52.222-27 Affirmative Action Compliance Requirements for Construction. (APR 2015)

52.222-35 Equal Opportunity for Veterans. (JUL 2014)

52.222-36 Equal Opportunity for Workers with Disabilities. (JUL 2014)

52.222-37 Employment Reports on Veterans. (OCT 2025)

52.222-38 Compliance with Veteran's Employment Reporting Rights (FEB 2016)

52.222-40 Notification of Employee Rights Under the National Labor Relations Act. (DEC 2010)

52.222-50 Combating Trafficking in Persons. (NOV 2021)

52.222-54 Employment Eligibility Verification. (OCT 2025)

52.222-55 Minimum Wages Under Executive Order 13658. (JAN 2022)

52.222-62 Paid Sick Leave Under Executive Order 13706 (JAN 2022)

52.222-90 Addressing DEI Discrimination by Federal Contractors (APR 2026)

52.223-1 Bio-based Product Certification. (OCT 2025)

52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts. (OCT 2025)

52.223-3 Hazardous Material Identification and Material Safety Data. (OCT 2025)

52.223-5 Pollution Prevention and Right-to-Know Information. (MAY 2024)

52.223-9 Estimate of Percentage of Recovered Material Content for EPA-Designated Items. (MAY 2008)

52.223-10 Waste Reduction Program. (MAY 2024)

52.223-11 Ozone-Depleting Substances and High Global Warming Potential Hydrofluorocarbons. (OCT 2025)

52.223-19 Compliance With Environmental Management Systems (May 2011)

52.223-20 Aerosols. (May 2024)

52.223-21 Foams. (May 2024)

52.225-9 Buy American - Construction Materials. (OCT 2025)

52.225-10 Notice of Buy American Requirement - Construction Materials. (MAY 2014)

52.225-13 Restrictions on Certain Foreign Purchases. (FEB 2021)

52.226-8 Encouraging Contractor Polices to Ban Text Messaging While Driving (May 2024)

52.227-1 Authorization and Consent. (JUN 2020)

52.227-2 Notice and Assistance Regarding Patent and Copyright Infringement (JUN 2020)

52.227-4 Patent Indemnity--Construction Contracts. (DEC 2007)

52.228-2 Additional Bond Security. (OCT 1997)

52.228-5 Insurance - Work on a Government Installation. (JAN 1997)

52.228-11 Individual Surety -Pledges of Assets. (FEB 2021)

52.228-12 Prospective Subcontractor Requests for Bonds. (DEC 2022)

52.228-14 Irrevocable Letter of Credit. (NOV 2014)

52.228-15 Performance and Payment Bonds - Construction. (JUN 2020)

52.229-3 Federal, State, and Local Taxes. (FEB 2013)

52.232-5 Payments Under Fixed-Price Construction Contracts. (MAY 2014)

52.232-12 Advance Payment (OCT 2025)

52.232-13 Notice of Progress Payment (APR 84)

52.232-17 Interest. (MAY 2014)

52.232-18 Availability of Funds. (APR 1984)

52.232-23 Assignment of Claims. (MAY 2014)

52.232-27 Prompt payment for construction contracts. (Jan 2017)

52.232-33 Payment by Electronic Funds Transfer - System for Award Management. (OCT 2018)

52.232-39 Unenforceability of Unauthorized Obligations. (JUN 2013)

52.232-40 Providing Accelerated Payments to Small Business Subcontractors (MAR 2023)

52.233-1 Disputes. (AUG 2025)

52.233-3 Protest after Award. (AUG 2025)

52.233-4 Applicable Law for Breach of Contract Claim. (OCT 2025)

52.236-2 Differing Site Conditions. (MAY 2025)

52.236-3 Site Investigation and Conditions Affecting the Work. (MAY 2025)

52.236-4 Physical Data (Apr 1984)

52.236-5 Material and Workmanship. (APR 1984)

52.236-6 Superintendence by the Contractor. (AUG 2025)

52.236-7 Permits and Responsibilities. (AUG 2025)

52.236-8 Other Contracts. (AUG 2025)

52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements. (AUG 2025)

52.236-10 Operations and Storage Areas. (AUG 2025)

52.236-11 Use and Possession Prior to Completion. (AUG 2025)

52.236-12 Cleaning Up. (AUG 2025)

52.236-13 Accident Prevention. (NOV 1991)

52.236-14 Availability and Use of Utility Services. (AUG 2025)

52.236-15 Schedules for Construction Contracts. (AUG 2025)

52.236-17 Layout of Work. (AUG 2025)

52.236-21 Specifications and Drawings for Construction. (AUG 2025)

52.236-26 Preconstruction Conference. (FEB 1995)

52.242-13 Bankruptcy. (JUL 1995)

52.242-14 Suspension of Work. (APR 1984)

52.243-4 Changes. (JUN 2025)

52.244-6 Subcontracts for Commercial Items (June 2025)

52.245-1 - Government Property (SEP 2021)

52.245-9 Use and Charges (APR 2012)

52.246-21 Warranty of Construction. (MAR 1994)

52.248-3 Value Engineering - Construction. (OCT 2025)

52.249-2 Termination for Convenience of the Government (Fixed-Price). (APR 2012)

52.249-10 Default (Fixed-Price Construction). (APR 1984)

52.251-1 Government Supply Sources. (APR 2012)

52.252-2 Clauses Incorporated by Reference. (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): https://www.acquisition.gov/

(End of clause)

52.253-1 Computer Generated Forms. (OCT 2025)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): Revolutionary FAR Overhaul | Acquisition.GOV

Contract Terms and Conditions Applicable to DHS Acquisition of Commercial Items (JUL 2023) The Contractor agrees to comply with any provision or clause that is incorporated herein by reference to implement agency policy applicable to acquisition of commercial items or components. The provision or clause in effect based on the applicable regulation cited on the date the solicitation is issued applies unless otherwise stated herein. The following provisions and clauses are incorporated by reference:

(b) Clauses.

_X___3052.204-71 Contractor Employee Access.

_X___3052.205-70 Advertisement, Publicizing Awards, and Releases.

_X__ 3052.215-70 Key Personnel or Facilities.

_X___3052.228-70 Insurance.

_X_3052.242-72 Contracting Officer's Representative.

(End of clause)

3052.209-70 Prohibition on contracts with corporate expatriates (JUN 2006)

3052.211-70 Index for specifications. (DEC 2003)

3052.222-70 Strikes or picketing affecting timely completion of the contract work. (DEC 2003)

3052.222-71 Strikes or picketing affecting access to a DHS facility. (DEC 2003)

3052.223-70 Removal or disposal of hazardous substances--applicable licenses and permits. (JUN 2006)

3052.225-70 Requirement for Use of Certain Domestic Commodities. (NOV 2024)

J - List of Documents, Exhibits and Other Attachments

List of Documents, Exhibits, and Other Attachments

Attachment Number	Title
1	Statement of Work
1A	Specifications
2	SF 25 - Performance Bonds
3	SF 25A - Payment Bonds
4	SF 28 - Affidavit of Individual Surety
5	Format for Irrevocable Letter of Credit
6	Format for Financial Institution
7	FTC.FMD-70 - Invoice Cover Sheet
8	Instruction for Completing WH-347
9	WH 347 - Wage and Hour Division
10	FMD 42 - Daily Report
11	DHS 11000-6 - Non-Disclosure Agreement
12A	12 FLETC Form 121-00-02 Badge Application form
12B	FLETC Criminal History Form
13A	13 USCIS Form I-9 - Instructions for Employment
13B	USCIS Form I-9
14	OF 306 Declaration for Federal Employment
15	SF 85 - Questionnaire for Non-Sensitive Positions
16	Security Handout
17	Security Training List
18	GA Construction Requirements Statute Wage Determination Building
19	SF 1413 - Statement and Acknowledgment
20	SF 1444 - Request for Authorization of Additional Classification and Rate
21	SF 24 - Bid Bond

Attachment Number	Title
22	SF LLC - Disclosure of Lobbying Activities
23	Financial Questionnaire
24	DHS 700-3 - Contractor Release Form
25	WH 1321 - DOL Poster
26	Proposal Data Sheet
27	PPQ Assessment Sheet
28	Past Performance Questionnaire
28A	Experience Information Form
Exhibit A	Bid Schedule and Proposal Breakdown

K - Representations, Certifications, and Other Statements of Bidders

Clauses

52.204-3 Taxpayer Identification. (OCT 1998)

(a) *Definitions*.

Common parent, as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

Taxpayer Identification Number (TIN), as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) *Taxpayer Identification Number (TIN)*.

[ ] TIN: _____.

[ ] TIN has been applied for.

[ ] TIN is not required because:

[ ] Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

[ ] Offeror is an agency or instrumentality of a foreign government;

[ ] Offeror is an agency or instrumentality of the Federal Government.

(e) *Type of organization*.

[ ] Sole proprietorship;

[ ] Partnership;

[ ] Corporate entity (not tax-exempt);

[ ] Corporate entity (tax-exempt);

[ ] Government entity (Federal, State, or local);

[ ] Foreign government;

[ ] International organization per 26 CFR 1.6049-4;

[ ] Other _____.

(f) *Common parent*.

[ ] Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

[ ] Name and TIN of common parent:

Name _____

TIN _____

(End of provision)

52.204-8 Annual Representations and Certifications. (MAR 2026)

(a)

(1) The North American Industry Classification System (NAICS) code for this acquisition is____*236220*_____.

(2) The small business size standard is ___*$45M* _____.

(3) The small business size standard for a concern that submits an offer, other than on a construction or service acquisition, but proposes to furnish an end item that it did not itself manufacture, process, or produce is 500 employees, or 150 employees for information technology value-added resellers under NAICS code 541519 if the acquisition—

(i) Is set aside for small business and has a value above the simplified acquisition threshold;

(ii) Uses the HUBZone price evaluation preference regardless of dollar value, unless the offeror waives the price evaluation preference; or

(iii) Is an 8(a), HUBZone, service-disabled veteran-owned, economically disadvantaged women-owned, or women-owned small business set-aside or sole-source award regardless of dollar value.

(b)

(1) If the provision at 52.204-7, System for Award Management, is included in this solicitation, paragraph (d) of this provision applies.

(2) If the provision at 52.204-7, System for Award Management, is not included in this solicitation, and the Offeror has an active registration in the System for Award Management (SAM), the Offeror may choose to use paragraph (d) of this provision instead of completing the corresponding individual representations and certifications in the solicitation. The Offeror shall indicate which option applies by checking one of the following boxes:

(i) ☐Paragraph (d) applies.

(ii) ☐Paragraph (d) does not apply and the offeror has completed the individual representations and certifications in the solicitation.

(c)

(1) The following representations or certifications in SAM are applicable to this solicitation as indicated:

(i) 52.203-2, Certificate of Independent Price Determination. This provision applies to solicitations when a firm-fixed-price contract or fixed-price contract with economic price adjustment is contemplated, unless–

(A) The acquisition is to be made under the simplified acquisition procedures in part 13;

(B) The solicitation is a request for technical proposals under two-step sealed bidding procedures; or

(C) The solicitation is for utility services for which rates are set by law or regulation.

(ii) 52.203-11, Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions. This provision applies to solicitations expected to exceed $200,000.

(iii) 52.203-18, Prohibition on Contracting with Entities that Require Certain Internal Confidentiality Agreements or Statements-Representation. This provision applies to all solicitations.

(iv) 52.204-3, Taxpayer Identification. This provision applies to solicitations that do not include the provision at 52.204-7, System for Award Management.

(v) 52.204-5, Women-Owned Business (Other Than Small Business). This provision applies to solicitations that-

(A) Are not set aside for small business concerns;

(B) Exceed the simplified acquisition threshold; and

(C) Are for contracts that will be performed in the United States or its outlying areas.

(vi) 52.204-26, Covered Telecommunications Equipment or Services-Representation. This provision applies to all solicitations.

(vii) 52.209-2, Prohibition on Contracting with Inverted Domestic Corporations-Representation.

(viii) 52.209-5, Certification Regarding Responsibility Matters. This provision applies to solicitations where the contract value is expected to exceed the simplified acquisition threshold.

(ix) 52.209-11, Representation by Corporations Regarding Delinquent Tax Liability or a Felony Conviction under any Federal Law. This provision applies to all solicitations.

(x) 52.214-14, Place of Performance-Sealed Bidding. This provision applies to invitations for bids except those in which the place of performance is specified by the Government.

(xi) 52.215-6, Place of Performance. This provision applies to solicitations unless the place of performance is specified by the Government.

(xii) 52.219-1, Small Business Program Representations (Basic, Alternates I, and II). This provision applies to solicitations when the contract is for supplies to be delivered or services to be performed in the United States or its outlying areas, or when the contracting officer has applied part 19 in accordance with 19.000(b)(1)(ii).

(A) The basic provision applies when the solicitations are issued by other than DoD, NASA, and the Coast Guard.

(B) The provision with its Alternate I applies to solicitations issued by DoD, NASA, or the Coast Guard.

(C) The provision with its Alternate II applies to solicitations that will result in a multiple-award contract with more than one NAICS code assigned.

(xiii) 52.219-2, Equal Low Bids. This provision applies to solicitations when contracting by sealed bidding and the contract is for supplies to be delivered or services to be performed in the United States or its outlying areas, or when the contracting officer has applied part 19 in accordance with 19.000(b)(1)(ii).

(xiv) 52.222-22, Previous Contracts and Compliance Reports. This provision applies to solicitations that include the clause at 52.222-26, Equal Opportunity.

(xv) 52.222-25, Affirmative Action Compliance. This provision applies to solicitations, other than those for construction, when the solicitation includes the clause at 52.222-26, Equal Opportunity.

(xvi) 52.222-38, Compliance with Veterans' Employment Reporting Requirements. This provision applies to solicitations when it is anticipated the contract award will exceed the simplified acquisition threshold and the contract is not for acquisition of commercial products or commercial services.

(xvii) 52.223-1, Biobased Product Certification. This provision applies to solicitations that require the delivery or specify the use of biobased products in USDA-designated product categories; or include the clause at 52.223-2, Reporting of Biobased Products Under Service and Construction Contracts.

(xviii) 52.223-4, Recovered Material Certification. This provision applies to solicitations that are for, or specify the use of, EPA–designated items.

(xix) 52.223-22, Public Disclosure of Greenhouse Gas Emissions and Reduction Goals-Representation. This provision applies to solicitations that include the provision at 52.204-7.

(xx) 52.225-2, Buy American Certificate. This provision applies to solicitations containing the clause at 52.225-1.

(xxi) 52.225-4, Buy American-Free Trade Agreements-Israeli Trade Act Certificate. (Basic, Alternates II and III.) This provision applies to solicitations containing the clause at 52.225-3.

(A) If the acquisition value is less than $50,000, the basic provision applies.

(B) If the acquisition value is $50,000 or more but is less than $100,000, the provision with its Alternate II applies.

(C) If the acquisition value is $100,000 or more but is less than $105,767, the provision with its Alternate III applies.

(xxii) 52.225-6, Trade Agreements Certificate. This provision applies to solicitations containing the clause at 52.225-5.

(xxiii) 52.225-20, Prohibition on Conducting Restricted Business Operations in Sudan-Certification. This provision applies to all solicitations.

(xxiv) 52.225-25, Prohibition on Contracting with Entities Engaging in Certain Activities or Transactions Relating to Iran-Representation and Certifications. This provision applies to all solicitations.

(xxv) 52.226-2, Historically Black College or University and Minority Institution Representation. This provision applies to solicitations for research, studies, supplies, or services of the type normally acquired from higher educational institutions.

(2) The following representations or certifications are applicable as indicated by the Contracting Officer:

[*Contracting Officer check as appropriate.*]

__ (i) 52.204-17, Ownership or Control of Offeror.

__ (ii) 52.204-20, Predecessor of Offeror.

__ (iii) 52.222-18, Certification Regarding Knowledge of Child Labor for Listed End Products.

__ (iv) 52.222-48, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment- Certification.

__ (v) 52.222-52, Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services-Certification.

__ (vi) 52.227-6, Royalty Information.

__ (A) Basic.

__ (B) Alternate I.

__ (vii) 52.227-15, Representation of Limited Rights Data and Restricted Computer Software.

(d) The offeror has completed the annual representations and certifications electronically in SAM website accessed through https://www.sam.gov. After reviewing the SAM information, the offeror verifies by submission of the offer that the representations and certifications currently posted electronically that apply to this solicitation as indicated in paragraph (c) of this provision have been entered or updated within the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer and are incorporated in this offer by reference (see FAR 4.1201); except for the changes identified below [*offeror to insert changes, identifying change by clause number, title, date*]. These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer.

FAR Clause #	Title	Date	Change

_____

Any changes provided by the offeror are applicable to this solicitation only, and do not result in an update to the representations and certifications posted on SAM.

(End of provision)

52.204-17 Ownership or Control of Offeror. (AUG 2020)

a) Definitions. As used in this provision–

Commercial and Government Entity (CAGE) code means–

(1) An identifier assigned to entities located in the United States or its outlying areas by the Defense Logistics Agency (DLA) Commercial and Government Entity (CAGE) Branch to identify a commercial or government entity by unique location; or

(2) An identifier assigned by a member of the North Atlantic Treaty Organization (NATO) or by the NATO Support and Procurement Agency (NSPA) to entities located outside the United States and its outlying areas that the DLA Commercial and Government Entity (CAGE) Branch records and maintains in the CAGE master file. This type of code is known as a NATO CAGE (NCAGE) code.

Highest-level owner means the entity that owns or controls an immediate owner of the offeror, or that owns or controls one or more entities that control an immediate owner of the offeror. No entity owns or exercises control of the highest level owner.

Immediate owner means an entity, other than the offeror, that has direct control of the offeror. Indicators of control include, but are not limited to, one or more of the following: ownership or interlocking management, identity of interests among family members, shared facilities and equipment, and the common use of employees.

(b) The Offeror represents that it ☐has or ☐does not have an immediate owner. If the Offeror has more than one immediate owner (such as a joint venture), then the Offeror shall respond to paragraph (c) and if applicable, paragraph (d) of this provision for each participant in the joint venture.

(c) If the Offeror indicates "has" in paragraph (b) of this provision, enter the following information:

Immediate owner CAGE code: _____

Immediate owner legal name: _____

(Do not use a "doing business as" name)

Is the immediate owner owned or controlled by another entity?: ☐Yes or ☐No.

(d) If the Offeror indicates "yes" in paragraph (c) of this provision, indicating that the immediate owner is owned or controlled by another entity, then enter the following information:

Highest-level owner CAGE code: _____

Highest-level owner legal name: _____

(Do not use a "doing business as" name)

(End of provision)

52.204-19 Incorporation by Reference of Representations and Certifications. (DEC 2014)

52.204-20 Predecessor of Offeror. (AUG 2020)

(a) Definitions. As used in this provision-

Commercial and Government Entity (CAGE) code means-

(1) An identifier assigned to entities located in the United States or its outlying areas by the Defense Logistics Agency (DLA) Commercial and Government Entity (CAGE) Branch to identify a commercial or government entity; or

(2) An identifier assigned by a member of the North Atlantic Treaty Organization (NATO) or by the NATO Support and Procurement Agency (NSPA) to entities located outside the United States and its outlying areas that the DLA Commercial and Government Entity (CAGE) Branch records and maintains in the CAGE master file. This type of code is known as a NATO CAGE (NCAGE) code.

Predecessor means an entity that is replaced by a successor and includes any predecessors of the predecessor.

Successor means an entity that has replaced a predecessor by acquiring the assets and carrying out the affairs of the predecessor under a new name (often through acquisition or merger). The term "successor" does not include new offices/divisions of the same company or a company that only changes its name. The extent of the responsibility of the successor for the liabilities of the predecessor may vary, depending on State law and specific circumstances.

(b) The Offeror represents that it [ ] is or [ ] is not a successor to a predecessor that held a Federal contract or grant within the last three years.

(c) If the Offeror has indicated "is" in paragraph (b) of this provision, enter the following information for all predecessors that held a Federal contract or grant within the last three years (if more than one predecessor, list in reverse chronological order):

Predecessor CAGE code: [(or mark "Unknown")].

Predecessor legal name: [(Do not use a "doing business as" name)].

(End of provision)

52.204-24 Representation Regarding Certain Telecommunications and Video. (NOV 2021)

52.204-26 Covered Telecommunications Equipment or Services-Representation. (OCT 2020)

52.209-7 Information Regarding Responsibility Matters. (OCT 2018)

(a) Definitions. As used in this provision—

Administrative proceeding means a non-judicial process that is adjudicatory in nature in order to make a determination of fault or liability (e.g., Securities and Exchange Commission Administrative Proceedings, Civilian Board of Contract Appeals Proceedings, and Armed Services Board of Contract Appeals Proceedings). This includes administrative proceedings at the Federal and State level but only in connection with performance of a Federal contract or grant. It does not include agency actions such as contract audits, site visits, corrective plans, or inspection of deliverables.

Federal contracts and grants with total value greater than $10,000,000 means—

(1) The total value of all current, active contracts and grants, including all priced options; and

(2) The total value of all current, active orders including all priced options under indefinite-delivery, indefinite-quantity, 8(a), or requirements contracts (including task and delivery and multiple-award Schedules).

Principal means an officer, director, owner, partner, or a person having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a division or business segment; and similar positions).

(b) The offeror □ has □ does not have current active Federal contracts and grants with total value greater than $10,000,000.

(c) If the offeror checked "has" in paragraph (b) of this provision, the offeror represents, by submission of this offer, that the information it has entered in the Federal Awardee Performance and Integrity Information System (FAPIIS) is current, accurate, and complete as of the date of submission of this offer with regard to the following information:

(1) Whether the offeror, and/or any of its principals, has or has not, within the last five years, in connection with the award to or performance by the offeror of a Federal contract or grant, been the subject of a proceeding, at the Federal or State level that resulted in any of the following dispositions:

(i) In a criminal proceeding, a conviction.

(ii) In a civil proceeding, a finding of fault and liability that results in the payment of a monetary fine, penalty, reimbursement, restitution, or damages of $5,000 or more.

(iii) In an administrative proceeding, a finding of fault and liability that results in–

(A) The payment of a monetary fine or penalty of $5,000 or more; or

(B) The payment of a reimbursement, restitution, or damages in excess of $100,000.

(iv) In a criminal, civil, or administrative proceeding, a disposition of the matter by consent or compromise with an acknowledgment of fault by the Contractor if the proceeding could have led to any of the outcomes specified in paragraphs (c)(1)(i), (c)(1)(ii), or (c)(1)(iii) of this provision.

(2) If the offeror has been involved in the last five years in any of the occurrences listed in (c)(1) of this provision, whether the offeror has provided the requested information with regard to each occurrence.

(d) The offeror shall post the information in paragraphs (c)(1)(i) through (c)(1)(iv) of this provision in FAPIIS as required through maintaining an active registration in the System for Award Management, which can be accessed via https://www.sam.gov (see 52.204-7).

(End of provision)

52.222-22 Previous Contracts and Compliance Reports. (FEB 1999)

The offeror represents that-

(a) It [ ] has, [ ] has not participated in a previous contract or subcontract subject the Equal Opportunity clause of this solicitation;

(b) It [ ] has, [ ] has not filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards. (End of provision)

52.222-38 Compliance with Veterans' Employment Reporting Requirements. (FEB 2016)

52.223-1 Biobased Product Certification. (MAY 2024)

52.223-4 Recovered Material Certification. (MAY 2008)

L - Instructions, Conditions, and Notices to Bidders

SUBMISSION REQUIREMENTS

Building 164 Glynco Ammo Cart Storage & Charging Shelter
Federal Law Enforcement Training Center, Glynco GA
Single Firm Fixed Price Contract
70LGLY26RSSB00019

ELECTRONIC PROPOSAL SUBMISSION IS REQUIRED. ELECTRONIC SUBMISSION SENT VIA FACSIMILE WILL NOT BE ACCEPTED. HAND CARRIED PROPOSAL SUBMISSION IS NOT AUTHORIZED.

DIRECTIONS FOR SUBMITTING PROPOSALS
All proposals shall be submitted electronically. All submissions shall be in Adobe PDF format, excluding the Offeror's bid schedule and any supporting bid schedule documentation. The Offeror shall submit bid schedule documentation via Excel; utilizing Exhibit A (Proposal Breakdown). The price proposal and any technical information provided shall be submitted as "*separate*" single files.

Please submit your proposal to the attention of the Contracting Officer at the following email address: courtney.p.brown@fletc.dhs.gov

Proposal Due Date and Time:

Request For Proposal No: 70LGLY26RSSB00019
Due Date of Proposal: July 15, 2026
Time by which Proposals are Due: 2:00 P.M. (E.T.)
Title of Project: Building 164 Glynco Ammo Cart Storage & Charging Shelter

The date and time of delivery will be established by the time of receipt of the e-mail notification to the Contracting Officer, not by the date and time of uploading the proposal for submission to the Contracting Officer. Do not assume that electronic communication is instantaneous. Please make allowances for delays in transmittal. If an electronic submission is uploaded minutes before the deadline but notification is not actually received in the recipients' e-mail inboxes until after the deadline, the submission will be considered late.

The Government will not be responsible for proposals delivered to any location or to anyone other than those designated to receive proposals on its behalf. The Offeror is responsible for ensuring that proposals are submitted so as to reach the designated recipient of proposals. The Offeror is responsible for allowing sufficient time for the proposal to be received in accordance with the information provided.

WAGE DETERMINATIONS: The appropriate wage determination for this firm fixed price requirement is: GA20260315 dated 05/18/2026 (please use the most recent determination at the time of proposal submission).

TECHNICAL MATTERS: Submit technical inquiries and questions relating to this solicitation to:
Contracting Officer, Courtney Brown at courtney.p.brown@fletc.dhs.gov

Cutoff date for technical inquiries and questions: **July 1, 2026**.

Responses to technical inquiries and questions will be provided by the Contracting Officer by: **July 6, 2026**.

Proposals shall be submitted in accordance with the following instructions:

Proposals shall be organized and tabbed in accordance with Submission Requirements identified below. Proposals shall be signed by a duly authorized official of the Offeror's company and are required no later than **2:00 PM eastern time on Tuesday, July 15, 2026**.

The Request for Proposal Packet must include the following:
Volume I Price

TAB A – Standard Form 1442, completed and signed by authorized individual(s)
TAB B – Section B – Proposal Pricing/Bid Schedule, Exhibit A
TAB C - Section K– Representations and Certifications.
TAB D – Financial Information (Completion of Attachment 23 and Letter from Offeror's Surety Company stating bonding capacity to include bonding aggregate)

Volume II Technical Requirements
TAB E - Past Performance

- No submissions are required, Government will evaluate PPIRS/CPARS records, etc. as outlined in Section M, Paragraph A

TAB F – Technical Requirements – Corporate Relevant Experience

- Tab F1 – Project Criteria - A minimum of two no more than three Past Performance Questionnaires as identified in Section M, paragraph B are required for submission (Attachment 27)

- Tab F2 - Copy of License(s), Certification(s) and Statement of Professional Credentials as identified in Section M. paragraph B

Clauses

52.204-7 System for Award Management. (NOV 2024)

52.215-20 Requirements for Certified Cost or Pricing Data or Data Other Than Cost or Pricing Data. (NOV 2021)

52.216-1 Type of Contract. (APR 1984)

The Government contemplates award of a Firm Fixed Price contract resulting from this solicitation.

(End of provision)

52.233-2 Service of Protest. (SEP 2006)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the Government Accountability Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from the following:

Department of Homeland Security
Federal Law Enforcement Training Center
Procurement Division
Specialized Services Branch
Building 681-FLETC

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

52.236-27 Site Visit (Construction). (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, Offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) A **site visit will be held on June 23, 2026, at 10:30am**. Please coordinate site access with Project Manager, Emerson Floyd at Emerson.Floyd@fletc.dhs.gov no later than **June 18, 2026, at 10:00am (local time)**. For site access requirements and further details on who will be allowed access to FLETC, please see Section H.29. Upon arrival, Attendees should report to the commercial gate for access, then proceed to Building 200. Questions regarding the site visit should be directed to:

Name: Emerson Floyd

Email: Emerson.Floyd@fletc.dhs.gov

Telephone: 912-580-5110

52.236-28 Preparation of Proposals - Construction. (OCT 1997)

(a) Proposals must be

(1) submitted on the forms furnished by the Government or on copies of those forms, and

(2) manually signed. The person signing a proposal must initial each erasure or change appearing on any proposal form.

(b) The proposal form may require offerors to submit proposed prices for one or more items on various bases, including -

(1) Lump sum price;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, offerors should insert the words “no proposal” in the space provided for any item on which no price is submitted.

(d) Alternate proposals will not be considered unless this solicitation authorizes their submission.

(End of Provision)

52.252-1 Solicitation Provisions Incorporated by Reference. (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es): Revolutionary FAR Overhaul | Acquisition.GOV

(End of provision)

M - Evaluation Factors for Award

EVALUATION CRITERIA

All Offeror’s proposal submissions shall be evaluated utilizing three factors as follows:

Non-Cost Factors:
Factor 1: Past Performance
Factor 2: Corporate Relevant Experience

Cost Factor:
Factor 3: Price

Order of Importance: All non-cost factors to include Past Performance and Corporate Relevant Experience are of equal importance to Price

A. FACTOR 1: Past Performance

The Government will review the Offeror's past performance information retrieved through the Past Performance Information Retrieval System (PPIRS), including Contractor Performance Assessment Reporting System (CPARS), the Federal Awardee Performance and Integrity Information System (FAPIIS), the Electronic Subcontract Reporting System (eSRS), and any other known sources. The Government will utilize the CAGE/Unique Identifier Number provided by the Offeror to retrieve past performance information. The Government will review records and data inputs for the past ten (10) years.

An overall assessment of the Offeror's Past Performance will be evaluated utilizing the aforementioned information retrieved. The Past Performance Rating will be based on the rating table identified below.

Past Performance Ratings	
Rating	**Definition**
(S) Superior	Based on the offeror's past performance record, it is highly likely that the offeror will successfully perform the required effort.
(S) Satisfactory	Based on the offeror's past performance record, it is likely that the offeror will successfully perform the required effort.
(N) Neutral	No relevant performance record is identifiable upon which to base a meaningful performance rating. The search was unable to identify any relevant past performance information for the offeror, key personnel, or subcontractors. This is neither a negative nor positive assessment.
(U) Unsatisfactory	Based on the offeror's past performance record, it is not likely that the offeror will successfully perform the required effort.

The past performance evaluation will result in an assessment of the Government's confidence in the ability of the Offeror to meet the solicitation requirements. The past performance evaluation considers the Offeror's demonstrated record of performance.

B. FACTOR 2: Corporate Relevant Experience

- **Project Criteria** (TAB F1)- Offerors shall submit two (2) and no more than four (4) Past Performance Questionnaires (PPQ's) (Attachment 28) for project work with the following criteria:

  (a) Offerors shall submit a minimum of two (2) and no more than four (4) projects with a minimum value of no less than $750,000.00. Each project/job must demonstrate comparable project size and same and/or similar scope of work that involves the construction of large steel engineered prefabricated enclosed red iron or other corrosion resistant steel buildings on engineered concrete foundations, including design and installation of plumbing systems, overhead coil doors, lighting, fire suppression systems, and large overhead ventilation fans. The contractor must also demonstrate experience in the design, engineering, and installation of building electrical systems capable of supporting high load applications such as vehicle or golf cart charging stations or other similar high load electrical requirements. Projects must have been completed within the last five (5) years or are at least 80% completed on the date of solicitation issuance.

  (b) Offerors may submit previously completed CPARS records for project criteria evaluation, however contact information on PPQ's must be current for purpose of reference.

  At a minimum, two PPQs must meet the project criteria specified in paragraph (a) above

- **License and Statement of Professional Credentials** (TAB F2) – In addition to PPQ's, Offerors shall submit:

  (a) A copy of License(s): Contractor to submit current license and qualifications. At a minimum, the Prime contractor must have a minimum of 5 years' experience in the industry of commercial construction to include large steel prefabricated enclosed red iron or other corrosion resistant steel buildings, engineered concrete foundations, commercial electrical systems, plumbing, overhead coil doors, lighting, fire suppression systems, and large overhead ventilation fans and/or similar work.

  (b) Statement of professional credentials; stating the Offeror's ability to complete the requirement in accordance with RFP requirements and within the scope and magnitude of the subject requirement. The Offeror shall:

  i) Identify any contractor/professional licenses held by the firm. (submit copies). A state of Georgia contractors license is not required but recommended. Contractor(s) shall be licensed and follow all state and local code.

  ii) Identify any certifications specific to the construction and installation of large steel prefabricated buildings, concrete foundations, electrical and plumbing systems, overhead doors, lighting, large fans, and similar work. (Submit copies)

An overall assessment of the Offeror's Corporate Relevant Experience will be evaluated utilizing the Past Performance Questionnaire, License(s), and Statement of Professional

Credentials as submitted by the Offeror. A Corporate Relevant Experience Rating will be assigned to the Offeror's technical submissions utilizing the rating table below:

Factor 2 – Corporate Relevant Experience	
Rating	**Definition**
(S) Superior	The proposal demonstrates that the contractor holds the required licensing and certifications outlined in the project specifications of commercial construction to include large steel prefabricated enclosed red iron or other corrosion resistant steel buildings, engineered concrete foundations, commercial electrical systems, plumbing, overhead coil doors, lighting, fire suppression systems, and large overhead ventilation fans and/or similar work. The contractor's qualifications and expertise ensure compliance with all relevant standards and regulations. The proposal highlights strengths that will provide significant benefits to the Government, with a low risk of unsuccessful performance.
(G) Good	The proposal demonstrates that the contractor possesses the necessary licensing required by the project specifications, including certifications and training for of commercial construction to include large steel prefabricated enclosed red iron or other corrosion resistant steel buildings, engineered concrete foundations, commercial electrical systems, plumbing, overhead coil doors, lighting, fire suppression systems, and large overhead ventilation fans and/or similar work. The proposal highlights one or more strengths that will provide clear benefits to the Government, with a low risk of unsuccessful performance.
(A) Acceptable	The proposal demonstrates that the contractor holds the necessary licensing required by the project specifications, including certifications for commercial construction to include large steel prefabricated enclosed red iron or other corrosion resistant steel buildings, engineered concrete foundations, commercial electrical systems, plumbing, overhead coil doors, lighting, fire suppression systems, and large overhead ventilation fans and/or similar work. The proposal offers an acceptable solution with few or no identified strengths, and the risk of unsuccessful performance is assessed as moderate.
(M) Marginal	The proposal demonstrates that the contractor possesses the licensing required by the project specifications for commercial construction to include large steel prefabricated enclosed red iron or other corrosion resistant steel buildings, engineered concrete foundations, commercial electrical systems, plumbing, overhead coil doors, lighting, fire suppression systems, and large overhead ventilation fans and/or similar work. However, significant weaknesses or deficiencies are present that may be correctable without major revisions to the proposal. The risk of unsuccessful performance is assessed as high.
(U) Unsatisfactory	The proposal fails to demonstrate that the contractor meets the licensing requirements outlined in the project specifications for commercial construction to include large steel prefabricated enclosed red iron or other corrosion resistant steel buildings, engineered concrete foundations, commercial electrical systems, plumbing, overhead coil doors, lighting, fire suppression systems, and large overhead ventilation fans and/or similar work. As a result, a contract cannot be awarded based on this proposal.

C. Factor 3: Price

The Contracting Officer will perform the price analysis, in accordance with FAR 15.404-1(b), to determine fairness and reasonableness as well as to ensure the Offeror's understanding of the work and ability to execute the work at the price proposed. The Contracting Officer will:

1. Ensure that the price proposal and resulting evaluation are not compromised by team members not directly, or not authorized to be involved in the price evaluation process.

2. Review the proposal to determine price submission errors or omissions and areas requiring clarification.

3. Evaluate proposal for price reasonableness. Reasonableness will be established using available pricing tools such as historical pricing data and/or the Independent Government Estimate.

C. Basis for Award and Exchanges with Best Suited Contractor:

a) Offerors are reminded to include their best technical and price terms in their initial offer. To determine which proposal represents the best suited contractor, proposals will be evaluated against all RFP criteria.

b) Proposals must meet the criteria stated in the RFP to be eligible for award, to include responsiveness, technical acceptability, and responsibility. A responsibility determination will be made in accordance with the Federal Acquisition Regulation (FAR) 9.1.

c) Award will be made on the basis of the best suited then negotiate methodology.

d) In order to be considered for project award, at a minimum, the Offeror must obtain a satisfactory rating for Past Performance and a rating of Acceptable for Corporate Relevant Experience. The Offeror is advised that any offer wherein pricing is deemed unfair, unreasonable, or unrealistic may be rendered ineligible for award. Historical price information, the Independent Government Estimate (IGE), or any other pricing tool as necessary will be utilized in making this determination. Based on an overall assessment of the Offeror's proposal to include cost as well as non-cost factors, the Government reserves the right to award to other than the lowest price or highest price Offeror.

e) Once the Government determines the contractor that is the best-suited (i.e., the apparent successful contractor), the Government reserves the right to communicate with only that contractor to address any remaining issues, if necessary, and finalize a task order with that contractor. These issues may include technical and price. If the parties cannot successfully address any

remaining issues, as determined pertinent at the sole discretion of the Government, the Government reserves the right to communicate with the next best-suited contractor based on the original analysis and address any remaining issues. Once the Government has begun communications with the next best-suited contractor, no further communications with the original best contractor will be entertained until after the purchase order has been awarded. This process shall continue until an agreement is successfully reached and a single firm-fixed price contract has been awarded.

If negotiations with the next best-suited offeror/quoter are not successful, then the Government may still use FAR procedures to conduct negotiations with all offerors/quoters or establish a competitive range.

f) The Government reserves the right to reject any and all offers.

g) Offerors are reminded to include their best technical and price terms in their initial offer and not to automatically assume that they will have an opportunity to participate in interchanges or be asked to submit a revised offer. The Government may make award of a conforming proposal without interchanges, if deemed to be within the best interests of the Government.