

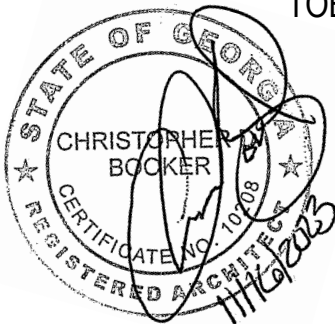
**RICHMOND COUNTY BOARD OF EDUCATION  
BOND ISSUE PROGRAM**

**BID DOCUMENTS**

FOR CONSTRUCTION OF PROJECT B-21-016-0294

TOBACCO ROAD ROOFING PROJECT

TOBACCO ROAD ELEMENTARY SCHOOL



**Owner**

Richmond County Board of Education  
864 Broad Street  
Augusta, GA 30901

**Program Manager**

GMK Associates, Inc.  
864 Broad Street  
Augusta, GA 30901



**Architect**

Christopher Booker & Associates PC .  
670 Broad Street  
Second Floor  
Augusta, GA 30901





**RICHMOND COUNTY BOARD OF EDUCATION**  
**Bond Issue Program**

**PROPOSAL NUM. B21-016-0294**  
**TOBACCO ROAD ROOFING PROJECT**

**PROJECT DIRECTORY**

**Owner:**

**Richmond County Board of Education**

Administrative Offices

(706) 826-1010

864 Broad Street

Augusta, GA 30901

**Program Manager:**

***GMK Associates, Inc.***

(706) 826-1127

864 Broad Street

(706) 826-4615 Fax

Augusta, GA 30901

**Architect:**

**Christopher Booker and Associates PC**

(706) 798-6792

670 Broad Street

Second Floor

Augusta, GA 30901

**Consulting Engineers:**

**Delta Engineering Group**

(706) 364-1770

3604 Wheeler Rd.

Suite C

Augusta, GA 30909



**TOBACCO ROAD ROOFING PROJECT**  
2397 TOBACCO, AUGUSTA, GA 30906  
PHASE VI BOND ISSUE PROGRAM B-21-016-0294

**TABLE OF CONTENTS**

SECTION A	INVITATION TO BID
SECTION B	PROPOSAL FORM
SECTION C	INSTRUCTION TO BIDDERS
SECTION D	INDEX TO GENERAL CONDITIONS
SECTION E	GENERAL CONDITIONS
SECTION F	SPECIAL CONDITIONS
SECTION G	PROJECT CLOSEOUT REQUIREMENTS AND PROCEDURES

Division	Section Title	Pages
<b>DIVISION 1 - GENERAL REQUIREMENTS</b>		
01210	ALLOWANCES	
01230	ALTERNATES	
01310	PROJECT MANAGEMENT AND COORDINATION	
01400	QUALITY REQUIREMENTS	
01700	EXECUTION REQUIREMENTS	
01732	SELECTIVE DEMOLITION	
01770	CLOSEOUT PROCEDURES	
01781	PROJECT RECORD DOCUMENTS	
<b>DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES</b>		
061000	ROUGH CARPENTRY	
<b>DIVISION 7 - THERMAL AND MOISTURE PROTECTION</b>		
07015	PREPARATION FOR REROOFING	
07530	ADHERED EPDM ROOFING	
076200	SHEET METAL FLASHING AND TRIM	
<b>DIVISION 15 – MECHANICAL</b>		
23000	GENERAL MECHANICAL PROVISIONS	
23050	BASIC MECHANICAL MATERIALS AND METHODS	
230512	MOTOR CONTROLLER FOR HVAC EQUIPMENT	
230517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING	
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT	

230593	TESTING ADJUSTING AND BALANCING FOR HVAC
230713	DUCT INSULATION
230719	HVAC PIPING INSULATION
230900	INSTRUMENTATION AND CONTROL FOR HVAC
230993	SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
232113	CONDENSATE PIPING
232300	REFRIGERANT PIPING
233113	METAL DUCTS
237413	PACKAGED ROOFTOP UNITS
238126	SPLIT SYSTEM HEAT PUMPS AND AIR CONDITIONERS

END OF TABLE OF CONTENTS

**COUNTY BOARD OF EDUCATION OF RICHMOND COUNTY  
INVITATION TO BID**

Sealed proposals from Contractors will be received for the Tobacco Road Roofing Project, Project # B21-016-0294 by the County Board of Education of Richmond County at the address below until **3:00 p.m.** local time, **April 18, 2024**, at which time the bids will be publicly opened and read. No extension of the bidding period will be made. The bids will be received in the Board Conference Room, Richmond County Board of Education, 864 Broad Street, Augusta, Georgia 30901.

A Pre-Bid Conference will be held **Tuesday, March 19, 2024, 2:00 pm** local time, at Tobacco Road Elementary School, 2397 Tobacco Road, Augusta, Georgia 30906.

Drawings and project manual on this work may be examined at the Department of Maintenance and Facilities, Richmond County Board of Education, 2965 Mike Padgett Highway, Augusta, Georgia 30906.

Hard copies of the Bidding documents may be obtained at the Office of the Architect: Christopher Booker & Associates PC, 670 Broad Street, Second Floor, Augusta, GA 30901. Applications for documents together with refundable deposit of **\$ 150** per set should be filed promptly with the Architect. Bidding material will be forwarded (shipping charges collect) as soon as possible. The full amount of deposit for one set will be refunded to each prime contractor who submits a bona fide bid upon return of such set in good condition within 10 days after date of opening bids. All other deposits will be refunded with deductions approximating the cost of reproduction of documents upon return of same in good condition within 10 days after date of opening bid.

**ELECTRONIC BIDDING DOCUMENTS MAY BE OBTAINED DIRECTLY FROM THE ARCHITECT. REQUESTS MAY BE MADE BY EMAIL BY CONTACTING MELISSA@CBARCHITECTSPC.COM. A LINK WILL BE PROVIDED FOR IMMEDIATE DOWNLOAD OF PLANS AND SPECIFICATIONS. ONLY REGISTERED PLAN HOLDERS REQUESTING THE DOCUMENTS FROM THE ARCHITECT WILL BE NOTIFIED OF THE PUBLISHED ADDENDA.**

Contract, if awarded, will be on a lump sum basis. No bid may be withdrawn for a period of 35 days after time has been called on the date of opening.

Bid must be accompanied by a bid bond in an amount not less than 5% of the base bid. Personal checks, certified checks, letters of credit, etc., are not acceptable. The successful bidder will be required to furnish performance and payment bonds in an amount equal to 100% of the contract price.

The Owner reserves the right to reject any and all bids and to waive technicalities and informalities.

To promote local participation, a database of Sub-contractors, Suppliers, and Vendors has been developed by the Program Manager, GMK Associates. Contact Jeanine Usry with GMK Associates at (706) 826-1127 for location to review and obtain this database.

Bids shall be submitted and addressed to:

Dr. Kenneth Bradshaw  
County Board of Education of Richmond County  
Administrative Office  
864 Broad Street  
Augusta, Georgia 30901  
c/o: Mr. Bobby Smith, CPA





SECTION B - PROPOSAL FORM

\_\_\_\_\_  
INSERT NAME AND ADDRESS

DATE \_\_\_\_\_

RE: Project No. B21-016-0294  
TOBACCO ROAD ROOFING PROJECT  
2397 TOBACCO ROAD, AUGUSTA, GA 30906

Ladies and Gentlemen:

B-01 Having carefully examined the specifications entitled, "Project No. B21-016-0294, TOBACCO ROAD ELEMENTARY SCHOOL ROOFING PROJECT, Richmond County", and the drawings similarly entitled, numbered, all dated **11.08.2023** and addendum (a) Nos. \_\_\_\_\_, as well as the premises and conditions affecting the work, the undersigned proposes to furnish all services, labor and materials called for by them for the entire work, in accordance with said documents for the sum of:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_)

which sum is hereafter called the "BASE BID"

B-02. The undersigned further proposes that should any of the following alternates or unit prices be accepted and is incorporated in the contract, the Base Bid may be altered if elected by the Owner as follows:

a) **ADD ALTERNATE # 1: Change EPDM Roof Membrane from 60 mil (Base Bid) to 90 mil**

**ADD SUM OF \_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_)**

B-03 a) If rock, boulders, weathered shale or other unsuitable materials as defined in the General Conditions is encountered by the contractor during the general overall grading operation, the Owner will pay the contractor \$ \_\_\_\_\_ per cubic yard for the removal and disposal of said materials off site.

b) If rock, boulders, weathered shale or other unsuitable materials as defined in the General Conditions is encountered by the contractor during the trench excavation, the Owner will pay the contractor \$ \_\_\_\_\_ per cubic yard for the removal and disposal of said materials off site.

c) The quantity of rock, boulders, weathered shale or other unsuitable materials as defined in the General Conditions will be as computed by the architect on the basis of measurements taken by the architect—excavation of said unsuitable materials is to be carried out only when authorized by the architect.

d) Rock payment lines are limited to the following:

1. Two feet outside concrete work for which forms are required, except \_\_\_\_\_ footings.
2. One foot outside perimeter of footings
3. In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3 feet minimum trench width.
4. Outside dimensions of concrete work where no forms are required.
5. Under slabs on grade, 6 inches below bottom of concrete slab.

B-04 For and in consideration of the sum of \$1.00, the receipt of which is hereby acknowledged, the undersigned agrees that this proposal may not be revoked or withdrawn after the time set for the opening of bids but shall remain open for acceptance for a period of thirty-five (35) days following such time

B-05 In case he be notified in writing by mail, email, or delivery of the acceptance of this proposal within thirty-five (35) days after the time set for the opening of bids, the undersigned agrees to execute within ten (10) days a contract (Form of Agreement Between Contractor and Owner, Form No. 418) for the work for the above stated compensation and at the same time to furnish and deliver to the Owner a performance bond and a payment bond in accordance with the forms shown in Article E-30 of the General Conditions of the Contract, both in an amount equal to 100% of the contract sum. Contractor shall also provide the required certificates of insurance (in accordance with Article E-27 of the General Conditions). Contractor will also provide a list of subcontractors, noting their business trade, estimated value of their work and business classification (MBE/WBE) for the Local Participation Report to the Board.

B-06 The undersigned agrees to commence actual physical work on the site with an equal force and equipment within ten (10) days after the notice-to proceed by the owner and to complete in \_\_\_\_\_ consecutive calendar days from and including said date.

B-07 Enclosed herewith is a bid bond in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) being not less than 5% of the Base Bid.

The undersigned agrees that the above stated amount is the proper measure of liquidated damages which the Owner will sustain by the failure of the undersigned to execute the contract and to furnish the performance bond and the payment bond in case this proposal is accepted and further agrees to the following:

B-08 If this proposal is accepted within thirty-five (35) days after the date set for the opening of bids and undersigned fails to execute the contract within ten (10) days after written notification of such acceptance or if he fails to furnish both a performance bond and a payment bond, the obligation of the bid bond will remain in full force and effect and the money payable thereon shall be paid into the funds of the Owner as liquidated damages for such failure; otherwise the obligation of the bond will be null and void.

B-09 The following subcontractors are listed for review by the Owner and Architect.

1. Plumbing \_\_\_\_\_
2. Mechanical \_\_\_\_\_
3. Electrical \_\_\_\_\_
4. Roofing \_\_\_\_\_
5. Sitework \_\_\_\_\_

B-10 The bidder submits the following statement of bidder's qualifications: (see next page)

B-11 The bidder submits the attached E-Verify Contractor Affidavit.

B-12 The bidder submits the attached Sex Offender Acknowledgement Form

Certified Checks Not Acceptable

STATEMENT OF BIDDER'S QUALIFICATIONS

To accompany bids submitted for  
Augusta, Georgia

Name of Bidder \_\_\_\_\_

Business Address \_\_\_\_\_

Phone Number \_\_\_\_\_ Fax Number \_\_\_\_\_

When Organized \_\_\_\_\_

Where Incorporated \_\_\_\_\_

Type of Business: General Contractor \_\_\_\_\_

Subcontractor \_\_\_\_\_

Other \_\_\_\_\_

Credit Available for this Contract \$ \_\_\_\_\_ \*

Contracts now in Hand \$ \_\_\_\_\_ \*

\* Within ten calendar days after bid date and prior to the award of the construction contract the contractor must furnish Program Manager/Owner a current audited financial statement.

Plan of Organization (Proprietorship, Partnership, Corporation)

\_\_\_\_\_

The Bidder has never refused to sign a contract at the original bid.

(True \_\_\_\_\_) (False \_\_\_\_\_)

The Bidder has never declared in default on a contract.

(True \_\_\_\_\_) (False \_\_\_\_\_)

By signing this document, I (the bidder) certify that construction, under this company's name, is my primary means of business and employment.

Remarks: \_\_\_\_\_

(The above statements must be subscribed and sworn to before a Notary Public).

Date \_\_\_\_\_

Firm Name \_\_\_\_\_

By \_\_\_\_\_

Title \_\_\_\_\_

\_\_\_\_\_  
(Notary Public)

Respectfully submitted,

Name \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

By \_\_\_\_\_

Title \_\_\_\_\_

The full names and addresses of persons and firms interested in the foregoing bids as principals are as follows:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

The legal name of the bidder is:

\_\_\_\_\_

**Contractor Affidavit under O.C.G.A. § 13-10-91 (b) (1)**

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services on behalf of Richmond County Board of Education has registered with, is authorized to use and uses the federal work authorization to use and uses federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned contractor will continue to use the federal work authorization program throughout the contract period and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the contractor with the information required by O.C.G.A. § 13-10-91 (b). Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

\_\_\_\_\_  
Federal Work Authorization User Identification Number

\_\_\_\_\_  
Date of Authorization

\_\_\_\_\_  
Name of Contractor

\_\_\_\_\_  
Name of Project

Richmond County Board of Education  
Name of Public Employer

I hereby declare under penalty that the foregoing is true and correct.

Executed on \_\_\_\_\_, \_\_\_\_\_ 20\_\_\_\_ in \_\_\_\_\_ (city), \_\_\_\_\_ (state).

\_\_\_\_\_  
Signature of Authorized Officer or Agent

\_\_\_\_\_  
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME  
ON THIS THE \_\_ DAY OF \_\_\_\_\_, 20\_\_\_\_\_.

\_\_\_\_\_  
NOTARY PUBLIC

My Commission Expires:  
  
\_\_\_\_\_

### Sex Offender Acknowledgement Form

**Read, sign and return this form to the Richmond County Board of Education**

The Contractor (or Vendor) shall not knowingly send any employee, agent or subcontractor personnel who is a registered sex offender or who has been convicted of sexual abuse to any school building or school property when students are attending school or a school related activity.

The Contractor (or Vendor) shall make periodic criminal history record inquiries as authorized by O.C.G.A. §35-3-34, as now written, or here-after amended; or allowed by all or any other laws allowing such inquiry, to identify these persons who have been convicted of sexual abuse or any other act which would require such person to be entered into a national or state sexual offender registry.

For the purpose of this policy, the term periodic shall mean that the criminal history record inquiries shall be made current upon the awarding of a successful bid on contract and checked no less than annually during the duration of the contract.

Upon notification and acceptance of the bid, the Contractor (or Vendor) shall certify to the Richmond County Board of Education that periodic criminal history record checks are made by the company for all employees and that to the best of the Contractor's (or Vendor) knowledge it has no employee or agent who has been convicted of a sex offense or who is a registered sex offender, who will be assigned to any school building or school property while students are attending school or a school related activity.

I have read and understand the above Richmond County Board of Education Policy regarding my or my company's obligation as a contractor (or vendor). I further acknowledge that the failure to comply with the requirements to identify a sex offender, to comply with any part of this policy, to assign a sex offender to any school building or school property while students are attending school or a school related activity will constitute a breach of the contract.

\_\_\_\_\_  
Contractor (or Vendor) signature

\_\_\_\_\_  
Date signed

\_\_\_\_\_  
Witness signature

\_\_\_\_\_  
Date signed

SECTION C

INSTRUCTIONS TO BIDDERS

**C-01. Basis of Contract.** - See invitation to bid and proposal form. (See also Article E-45)

**C-02. Bid Security.** - See invitation to bid and proposal form.

**C-03. Interpretations.** - No oral interpretation will be made to bidders as to the meaning of the drawings and specifications. Requests for interpretation of drawings and specifications must be made in writing to the architect not later than five (5) days prior to the date set for receipt of the proposals, and failure on the part of the successful bidder to do so shall not relieve him as contractor of the obligation to execute such work in accordance with a later interpretation by the architect. All interpretations made to bidders will be issued in the form of addenda to the plans and specifications and will be sent to all bidders. Such addenda are to be covered in the proposals, and in closing the contract they will become a part thereof. (See also Article E-45) It is the Program Manager/Owner's preference to have all addenda's distributed to all bidders at least three (3) working days prior to the bid date.

**C-04. Proposals.** - (a.) - Proposals will be opened and read as stated in the invitation to bid.

(b.) - All bids must be submitted on the same form as the specimen shown in Section B and must be signed. All blanks on the proposal form must be filled in. Three loose copies are furnished bidders for their use. Numbers shall be written in English words and in Arabic numerals, and the completed form shall be without interlineation, alteration or erasure. Failure to submit a proposal in the form requested or the inclusion of any condition, alternate, limitation or provision not called for will render the bid irregular and shall be considered sufficient cause for rejection of a bid. Failure to complete entries in all blanks in the proposal form shall be considered sufficient cause for rejection of a proposal.

(c.) - Proposals are to be addressed to the owner at the address and room number shown in the advertisement for bids and must be enclosed in an opaque, sealed envelope marked with the name and number of the job and identified with the words "Proposal for Construction". Bids are to reach the address designated in the invitation for bids not later than the hour and date named in the invitation for bids. After that time no bids may be received.

(d.) – Alternates:

(1) Deductive alternates may be used to reduce the base bid; if used, deductive alternates will be prioritized and exercised in numerical sequence as used in the bid documents.

(2) Additive alternates may be used; if used they may be exercised in any order.

(3) The Project shall be awarded by the base bid less any deductive alternate selected (if any); plus any Additive alternates selected (if any). To be clear, any deductive alternates and/or additive alternates selected will be used to determine the low bid.. (See Article E-47)

(e.) - Proposals together with the full bid security accompanying same may be withdrawn by bidders prior to the time set for official opening. After time has been called, no bid may be withdrawn for a period of thirty-five days after the TIME AND DATE of opening. Negligence or error on the part of any bidder in preparing his bid confers no right of withdrawal or modification of his bid after time has been called.

**C-05. Examination of Site.** - The bidder's attention is directed to Article E-15.

**C-06. Contract Form and Bonds.** - The bidder's attention is directed to Article B-05.

**C-07. Award.** - The owner reserves the right to reject any or all bids and to waive technicalities and informalities. (See also Article C-01)

**C-08. - Surety and Insurance Companies.** - The contract provides that the surety and insurance companies must be acceptable to the owner. To avoid inconvenience, any bidder or subcontractor should get in touch with the owner to determine whether the surety or insurance companies expected to be used on the work are acceptable to the owner. (See also Articles E-27 and E-30)

**C-09. - Employment of Georgia Citizens and Use of Georgia Products.** - Since the work provided for in this contract is to be performed in Georgia, it is the wish of the owner that materials and equipment manufactured or produced in Georgia shall be used in the work and that Georgia citizens shall be employed in the work at wages consistent with those being paid in the general area in which the work is to be performed. This desire on the part of the owner is not intended to restrict or limit competitive bidding or to increase the cost of the work; nor shall the fulfillment of this desire be asserted by the contractor as an excuse for any noncompliance or omission to fulfill any obligation under the contract.

#### IMPORTANT

**C-10. Trade Names.** - The attention of bidders and all other parties is called to the procedure under Article E-03 of general conditions for the submission of trade names, brand names, or names of manufacturers for approval which aforesaid procedure is used in place of what is commonly known as an "or equal" provision.

#### NOTES:

1. Before submitting a bid, each bidder shall examine the Drawings carefully, shall read the Specifications and all other Contract Documents, and shall visit the site of the Work. Each bidder shall fully inform himself prior to bidding as to existing conditions and limitations under which the Work is to be performed, and shall include in his bid a sum to cover the cost of items necessary to perform the work as set forth in the proposed Bidding Documents. The Bidding Documents have been prepared on the basis Of surveys and inspections of the site and physical conditions at the site. This, however does not relieve the Bidder of the necessity for fully informing himself as to the existing physical conditions. No allowance will be made to a bidder because of lack of such examination or knowledge. The submission of a bid will be considered as conclusive evidence that the bidder has made such examination.



2. Bidder has secured on-site measurements for quantities upon which Bidder's proposal is based and has observed all existing conditions and limitations.
3. Each bidder, when required, shall obtain a Contractor's license under the provisions of the Georgia Contractor's Licensing Law. Specialty Contractor's Licenses can be obtained for the various building trades and information regarding these licenses can be obtained from the Georgia Licensing Board for Contractors.
4. Attention is directed to the fact that these specifications include a set of Bid Forms. These are for the convenience of bidders and are not to be detached from the Specifications, or filled out, or executed. Separate copies of Bid Forms are furnished for that purpose, in triplicate, two to be submitted with the Bid and one to be retained by the bidder for his records. Architects instructs bidders to use this form and no other. Do not add to the form with any change.  
  
The Contractor, by signing the Contract, acknowledges that he is aware of and familiar with the contents and requirements of the following acts and executive orders:
  1. High Voltage Act, Georgia Law 1960, pp181-183
  2. Underground Gas Pipe Law- Georgia Law 1969, pp50-57
  3. William Steiger Occupational Safety and Health Act of 1970
  4. The non-discrimination clause contained in Section 202 Executive Order 11246 as amended by Executive Order 11375 related to Equal Employment Opportunity for all persons without regard to race, color, religion, sex, or national origin and the implementing rules and regulations described by the Secretary of Labor are incorporated.
  5. The act entitled "State Employees and Officials- Trading with the "State", Georgia Laws, 1956,pp.et seq
  6. Contractors must e-Verify their employees and all subcontractors in accordance with O.G.C. 13-10-91 and provide affidavits for themselves and subcontractors as required by Chapter 300-10-1 of the Georgia Department of Labor Code.
5. **DUTY TO PROTECT:** The Contractor (or Vendor) shall not knowingly send any employee, agent or subcontractor personnel who is a registered sex offender or who has been convicted of sexual abuse to any school building or school property when students are attending school or a school related activity. The Contractor (or Vendor) shall make periodic criminal history record inquiries as authorized by O.C.G.A. §35-3-34, as now written, or here-after amended; or allowed by all or any other laws allowing such inquiry, to identify these persons who have been convicted of sexual abuse or any other act which would require such person to be entered into a national or state sexual offender registry. For the purpose of this policy, the term periodic shall mean that the criminal history record inquiries shall be made current upon the awarding of a successful bid on contract and checked no less than annually during the duration of the contract. Sex Offender Acknowledgement Form is to be executed and included in the bid as provided in the SECTION B – Form of Proposal
6. In submitting a proposal, the bidder certifies that the provisions of the act entitled "State Employees and Officials- Trading with the State," Georgia Laws 1956, pp et seq. Have been complied with."
7. The drawings, Specifications and other documents furnished to bidders are the property of the Owner.

8. Return bidding documents to the address of the Architect as listed in the Directory. In returning bidding documents, include dated transmittal.
  
9. Each bidder shall carefully examine Drawing and Specifications and all Addenda or other revisions thereto and thoroughly familiarize himself with the detailed requirements thereof prior to submitting a proposal. If any bidder is in doubt as to the true meaning of any part of the Drawings, Specifications or other documents, or if any error, discrepancy, conflict or omission is noted, the bidder should immediately submit a written request for information to the Program Manager.  
  
The Program Manager will forward all such request to the Architect for clarification of the intent of the documents and/or correction of such error, discrepancy, conflict or omission and will notify all bidders by Addendum in cases where the extent of the work of the cost thereof will be appreciably affected. No allowance will be made after the bids are received for oversight by a bidder
  
10. Any explanations desired by bidder regarding the meaning or interpretation of the drawings and specifications should be requested in writing to the Architect.
  
11. "Oral explanations or instructions given before the award of the Contract will not be binding. Any interpretations made will be in the form of a Addendum to the Specifications or drawings and will be furnished to all bidders and its receipt by the bidder will be acknowledged on the form of proposal in the space provided."
  
12. The following products do not require further approval except for interface within the work:  
Products specified by reference to standard specifications such as ASTM and similar standards.
  
13. Bid Bonds will be returned to all except the three lowest bidders within ten days after formal opening of bids. The bid bonds of the three lowest bidders will be returned within 48 hours after Owner and Contractor have executed a Contract and the executed performance bond and payment bond has been approved by the Owner, or, if no award has been made within 60 days after the opening of bids, upon the demand of the bidder at anytime thereafter, so long as he has not been notified of the acceptance of this bid
  
14. It is strongly urged that all bidders deliver the bid to the location of the bid opening as indicated on the Invitation/Advertisement for Bids. Bidder is solely responsible for insuring delivery of bid to the proper location at the proper time. Delivery of bids which are mailed or otherwise transmitted to the Owner, Architect and Program Manager at a location other than the location of the bid opening indicated on the Invitation/Advertisement for Bids will not be guaranteed. Program Manager/Owner prefer bids to be hand delivered to place of bid. Bids faxed will not be accepted.
  
15. The owner reserves the right to accept or reject any and all bids when such rejection is in the interest of the Owner; to reject the bid of the bidder who has previously failed to perform or to complete on time Contracts of a similar nature; and to reject the bid of a bidder who is not, in the opinion of the Architect and Program Manager or Owner, in a position to perform the Contract. The Owner reserves the right to reject any subcontractor who has previously failed to perform properly in the opinion of the Architect, Program Manager or the Owner.

16. The Owner will follow the State of Georgia guidelines when considering award of contracts. The Project shall be awarded by the base bid less any deductive alternate selected (if any); plus any Additive alternates selected (if any). To be clear, any deductive alternates and/or additive alternates selected will be used to determine the low bid.
17. Proposals for each contract will be accepted from bidders who are regularly engaged in the work they are bidding, which represents a significant portion of their total volume and who perform this work with men regularly employed on their payrolls. Before a bid is considered for award, the bidder may be requested by the Architect or Program Manager to submit a statement of facts in detail as to his previous experience in performing similar or comparable work and of his business and technical organization and financial resources and plant available to be used in contemplated work. The bidder may also be required to submit a statement of facts in detail on his proposed subcontractors as to their previous experience and past performance on performing similar work or comparable work .
18. Failure to furnish bonds in a form satisfactory to Owner shall subject bidder to loss of time from the allowable construction period equal to delay time in furnishing material. The Owner reserves the right to reject the qualifications of any bonding company.
19. The bidder to whom the Contract is awarded shall, within ten calendar days after notice of award and receipt of Agreement forms from the Owner, sign and deliver required copies to the Owner.
20. At or prior to delivery of the signed Agreement, the bidder to whom the Contract is awarded shall deliver to the Owner those Certificates of Insurance required by the Contract Documents. The successful bidder will not be permitted to occupy the site of the work or allowed on the property of the Owner until Certificates of Insurance has been approved and the written Notice to Proceed is issued. Failure to furnish policies or Certificates in a form satisfactory to Owner shall subject Bidder to loss of time from the allowable construction period equal to delay time in furnishing material.
21. Not Used
22. A Pre-bid Conference will be held at the **Tobacco Road Elementary School, 2397 Tobacco Road, Augusta, GA , 2 P.M., Tuesday, March 19<sup>th</sup>,2024.** Pre-Bid Conference is not mandatory. Bidders are urged to attend.
23. The Architect wishes to call to the attention of the bidder that any set of plans and specifications not returned in good condition, such bidder will not receive his refund for same.
24. The General Contractor is responsible for obtaining and paying for **ALL** necessary permits, license, fees, electrical, sewer & water tap fees, etc., in connection with the completion of this contract.
25. The General Contractor and each Subcontractor and Material Supplier, must furnish an Affidavit similar to the following forms. These Affidavits must be delivered to the Architect within thirty (30) days after completion of work.

See Part 1, Division C. Pages C-6 through C-17 for Affidavit and Specimen Copy Forms.



SECTION D

INDEX TO GENERAL CONDITIONS

ARTICLE

E-01	General Conditions
E-02	Omitted
E-03	Trade Names
E-1	Definitions
E-2	Identification, Correlation, and Intent of Documents
E-3	Complete, Definite and Clear Instructions and Schedules of Drawings
E-3.1	Schedules
E-4	Copies of Contract Documents Furnished to Contractor
E-5	Shop Drawings
E-6	Drawings and Specifications at the Site
E-7	Ownership of Drawings and Models
E-8	Samples
E-9	Materials, Appliances, Employees
E-10	Royalties and Patents
E-11	Surveys, Permits, and Regulations
E-12	Protection of Work and Property
E-13	Inspection of Work
E-14	Superintendent and Supervision by Contractor
E-15	Changes in Work
E-16	Claims
E-17	Deduction for Uncorrected Work
E-18	Delays and Extensions of Time
E-19	Correction of Work Before Contractor's Monthly Application for Payment
E-20	Correction of Work After Final Payment
E-21	The Owner's Right to Work
E-22	Right of Owner to Terminate Contract
E-23	Contractor's Right to Stop Work or Terminate Contract
E-24	Application for Payment
E-25	Certificates of Payments
E-26	Payments Withheld
E-27	Insurance and Hazards
E-28	Affidavits
E-29	Omitted
E-30	Performance Bond and Payment Bond
E-31	Omitted
E-32	Liens
E-33	Assignments
E-34	Mutual Responsibility of Contractors
E-35	Separate Contracts
E-36	Subcontractors, Materialmen, Suppliers and Employees
E-37	Relationship of Contractor and Subcontractors
E-38	Architect
E-39	Architect's Decisions
E-40	Measurements and Dimensions
E-41	Notice of Readiness for Final Inspection
E-42	Use of Premises

E-43	Cutting, Patching, and Fitting
E-44	Cleaning Up
E-45	Specification Arrangement
E-46	Commencement, Prosecution, and Completion
E-47	Alternates
E-48	Contract Close-out
E-49	Conflicts
E-50	Progress Reports
E-51	Office for Program Manager
E-52	Trading with State Statute
E-53	Manufacturer's Recommendations
E-54	Keys
E-55	Operation and Maintenance Data and Instructions
E-56	Space Conditions
E-57	Cash Allowances
E-58	Testing Services
E-59	Drilling Samples and Log of Drilling Wells
E-60	Contractor's Warranty as to Performance
E-61	Staples Prohibited on Pipe and Ductwork Insulation
E-62	Mechanical Systems, Retainage Pending Balance of
E-63	Hot Water Heaters
E-64	Effect of Addenda, Amendments, Bulletins, Deletions, Omissions, and Change Orders
E-65	Concrete Specifications
E-66	House Bill No. 210
E-67	Certificates of Manufacturers for Major Components
E-68	Omitted
E-69	Copies of Notice to Owner
E-70	Utilities
E-71	Form of Agreement
	Form of Agreement Between Owner & Manufacturer

SECTION E

GENERAL CONDITIONS

**Article E-01.** The general conditions of the contract, Articles E-01 to E-71, inclusive, bound herein and hereafter referred to as the "general conditions", shall govern in the event of any conflict with any other provisions of the contract documents unless notice to the contrary shall have been issued by the owner bearing the imprimatur of the owner as follows:

"By order of (NAME OF OWNER), owner".

The architect has no authority to amend the general conditions orally or in writing either expressly or by implication.

NOTES:

**Article E-02.** Omitted

NOTES:

**Article E-03. Trade Names.** - When reference is made in the contract documents to trade names, brand names, or to the names of manufacturers, such references are made solely to indicate that products of that description may be furnished and are not intended to restrict competitive bidding. If it is desired to use products of trade or brand names or of manufacturers' names which are different from those mentioned in the contract documents, application for the approval of the use of such products must reach the hands of the architect at least five (5) days prior to the date set for the opening of bids. The latter provision is a restriction which applies only to the party making a submittal. Therefore, the aforesaid restriction does not inhibit the architect from adding trade names, brand names or names of manufacturers by addendum. The burden of proving acceptability of a proposed product for use in place of a product or products designated by trade name or names, brand name or names, or by the name or names of manufacturers in the contract documents rests on the party submitting the request for approval. The written application for approval of a proposed product must be accompanied by technical data which the party requesting approval desires to submit in support of his application. The architect will give consideration to reports from reputable independent testing laboratories, verified experience records showing the reputation of the proposed product with previous users, evidence of reputation of the manufacturer for prompt delivery, evidence of reputation of the manufacturer for efficiency in servicing its products, or any other written information that is helpful in the circumstances. The application to the architect for approval of a proposed product must be accompanied by a schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the contract documents. The degree of proof required for approval of a proposed product as acceptable for use in place of a named product or named products is that amount of proof necessary to convince a reasonable person beyond all doubt. To be approved, a proposed product must also meet or exceed all express requirements of the contract documents. If the submittal is approved by the architect, an addendum will be issued to all prospective bidders. Issuance of an addendum is a representation to all bidders that the architect in the exercise of his professional discretion established that the product submitted for approval is acceptable and meets or exceeds all express requirements. In the event a submittal shall have been rejected by the architect and there shall have been a request for a conference as provided in this article pursuant to which conference the said submittal shall have been found to comply with the requirements of this article, a separate addendum covering the said submittal will be issued prior to the opening of bids.

In order for the architect to prepare an addendum intelligently, an application for approval of a product must be accompanied by a copy of the published recommendations of the manufacturer for the installation of the product together with a complete schedule of changes in the drawings and specifications, if any, which must be made in other work in order to permit the use and installation of the proposed product in accordance with the recommendations of the manufacturer of the product. (See Article E-43 which requires the contractor to do all cutting and fitting that may be required to make the several parts of his work come together properly and fit. Unless requests for approvals of other products have been received and approvals have been published by addendum in accordance with the above procedure, the successful bidder may furnish no products of any trade names, brand names, or manufacturers' names except those designated in the contract documents. Any party who alleges that rejection of a submittal is the result of bias, prejudice, caprice, or error on the part of the architect may request a conference with a representative of the owner, *Provided:* That the request for said conference, submitted in writing, shall have reached the owner at least five days prior to the date set for the opening of bids, time being of the essence.

**NOTES:**

**Article E-1. Definitions.** - (a) *Contract Documents.* - The contract documents are as described in the form of agreement. Article E-71 of the general conditions. (See Article E-71 for specimen of form of agreement.)

(b) *Parties.* - The owner, the contractor and the architect are those mentioned as such in the form of agreement. They are treated throughout the contract documents as if each were of the singular number and masculine gender.

(c) *Subcontractor.* - The term subcontractor as employed herein includes only those having a direct contract with the contractor. It includes one who furnishes materials worked to a special design according to the plans and specifications of this work but does not include one who merely furnishes materials not so worked.

(d) *Notices.* - Written notices shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended or if delivered at or sent by registered mail to the last business address known to him who gives the notice.

(e) *Work.* - The term "work" of the contractor or subcontractor includes labor or materials or both.

(f) *Time Limits.* - All time limits stated in the contract documents or shown on the construction progress schedule are of the essence of the contract. (See also Article E-46)

(g) *Applicable Law.* - This contract shall be governed by the law of Georgia.

(h) *Specifications.* - The term "Specifications" shall include all written matter in the bound volume or on the drawings and any addenda or modifications thereto. (See also Article E-49)

(l) *Order of Condemnation.* - An order of condemnation shall be in writing, shall be dated, shall be signed by the architect, shall be addressed to the contractor with a copy to the owner, and shall contain three elements as follows:



FIRST ELEMENT: *Description of work...*

(1) which has been omitted or

(2) which is unexecuted as of the date of the order of condemnation, the time for its incorporation into the work under the construction progress schedule having expired (See also Article E-46), or

(3) which has not been executed in accordance with the methods and materials designated in the contract documents.

SECOND ELEMENT: *Citation* of the provision or provisions of the contract documents which has or have been violated.

THIRD ELEMENT: *Fixing* of a reasonable space of time within which the contractor shall have made good the deficiency which said space of time shall not be deemed to be an extension of contract time for filing the Notice of Readiness for Final Inspection pursuant to Article E-41 nor shall it be deemed to be authorization for amendment to the construction progress schedule. (See also Articles E-19, E-20, and E-50).

An order of condemnation may be issued for failure of the contractor to supply enough skilled workmen or enough materials or proper materials, the order of condemnation in such event being based on Article E-46, q.v. and upon the definition of work as set forth under Article E-1(e), q.v. (See also Article E-26)

(j) *Proceed Order*. - The proceed order is a written notice from the owner pursuant to which the contractor shall commence physical work on the site. (See Article E-46) A proceed order is a condition precedent to the execution of any work on the site by the contractor.

(k) *Work Order*. - A work order is a written notice from the owner issued separately to the contractor for each subcontractor. A work order is a condition precedent to the execution of any work on the site by the contractor.

(l) *Change Order Form*. - The change order form is the instrument by which adjustments in the contract sum are affected pursuant to changes made in accordance with Case (a), Case (b), or Case (c) of Article E-15 or in accordance with Subparagraph (l) of Article E-15. The change order form shall be accompanied by a breakdown in the form prescribed in a specimen which the owner will supply to any bidder upon request. The architect shall certify the amount of the adjustment, and the change form shall be signed by the contractor and the owner. The breakdown is only for the purpose of enabling the architect and the owner to make a judgment on the dollar amount of the adjustment in the contract sum. No condition, term, qualification, limitation, exception, exemption, modification, or proviso shall appear in a breakdown it shall be invalid unless expressly recited in the change order form under Paragraph 3, "Description of Change". Only such conditions, terms, qualifications, limitations, exceptions, exemptions, modifications, and provisos as are recited under Paragraph 3, "Description of Change", are valid. (See also Article E-15)

(m) *Install, Deliver, Furnish, Supply, Provide*. - Such words mean the work in question shall be put in place by the contractor ready for use unless expressly provided to the contrary.

(n) *Article Not Plenary*. - This article is not entire, plenary, or exhaustive of all terms used in the general conditions which require definition. There are definitions of other terms under articles to which the terms are related.

(o) *Grounds for Issuance of Notice of Declaration of Default.* - It shall be a sufficient ground for the issuance of a notice of declaration of default that the contractor has been unfaithful or delinquent in the performance of the contract or any of it in any respect. Without limitation of the foregoing and without subtracting from any right or defense of the owner under other provisions of the contract documents, the contractor acknowledges and agrees that it is *ipso facto* ground for issuance of a notice of declaration of default under the performance bond if the contractor shall have neglected or failed for any reason to remedy a breach of an order of condemnation within thirty (30) days after the owner shall have given written notice of said breach to the contractor and the surety on the performance bond with written demand of the owner for curing of the delinquency. The architect does not have authority to declare the contractor in default.

(p) *Cross-references and Citations of Articles and Paragraphs of the General Conditions.* - Cross-references and citations of articles and paragraphs of the general conditions are for the convenience of the contractor, architect, and the owner and are not intended to be plenary or exhaustive nor are they to be considered in interpreting the contract documents or any part of the contract documents.

(q) *Meaning of words and phrases.* - Unless the context or the contract documents taken as a whole indicate to the contrary, words used in the contract documents that the usual and common meanings shall be given their usual and common meanings and words having technical or trade meanings shall be given their customary meaning in the subject business, trade or profession.

**Article E-2. Identification, Correlation, and Intent of Documents:**

(a) *Identification.* - The architect shall identify the contract documents.

(b) *Correlation and Intent.* - The contract documents are complementary, and what is called for by one shall be as binding as if called for by all. The intention of the documents is to include all labor and materials, equipment, and transportation necessary for the proper execution of the work. It is not intended, however, that materials or work not covered by or properly inferable from any heading, branch, class, or trade of the specifications shall be supplied unless distinctly noted on the drawings. Materials or work described in words which so applied have a well-known technical or trade meaning shall be held to refer to such recognized standards. (See also Article E-9) In the event the architect shall have used such phrases anywhere in the specifications as : "Work indicated on the drawings and herein specified", "work shown and specified", "in accordance with drawings and applicable specifications", "these specifications and the accompanying drawings", "as indicated on the drawings and as specified herein", or similar expressions, they shall not be deemed to be and are not a defensible of the provisions under the present article of the general conditions, and they are not to be a requirement under the contract. Any of the aforesaid conjunctive expressions and phrases or any cross-references between drawings and specifications, between specifications and specifications, or between drawings and drawings to the contrary notwithstanding, the contract documents are complementary, and what is called for by one shall be as binding as if called for by all. (See also Articles E-1(m), E-36, E-37, and E-45)

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**Article E-3. Complete, Definite, and Clear Instructions and Schedules of Drawings.** - (a) *Refinement of Documents.* - The contractor shall do no work without complete, definite, and clear drawings and specifications. In the event the contract documents are not complete, definite, and clear the contractor shall make demand upon the architect in writing for additional instructions and shall furnish the owner a copy of the aforesaid demand. With reasonable promptness the architect shall furnish complete, definite, and clear instructions in writing, or by means of drawings, or in writing and by means of drawings. (See also Articles E-2, E-14, E-18, and E-39) Such additional instructions if given orally shall be confirmed in writing or by drawings or both within a reasonable space of time. All such additional instructions shall be consistent with the contract documents, true developments thereof, and reasonably inferable therefrom. The work shall be executed in conformity with the aforesaid instructions. The architect shall furnish the owner a copy of all additional instructions issued to the contractor. (See also Articles E-16 and E-39)

(b) *Schedules.* - The contractor shall prepare a critical path schedule, subject to change from time to time in accordance with the progress of the work, fixing the dates at which the various detail drawings will be required, and the architect shall furnish them in accordance with that schedule.

NOTES:

1. Unless Otherwise specifically stated, all manufacturer's catalogs, specifications, instructions or other information or literature that are referred to in the Specifications will be considered as the latest edition and/or revision of such publication that is in effect on the date of the Invitation or Advertisement for Bids.
2. When standard specification such as the American Society for Testing and Materials, Federal Specifications, Department of Commerce (Commercial Standards), American Institute of Steel Construction, or other well-known public or trade associations, are cited as a standard to govern materials and/or workmanship, such specifications or portions thereof as referred to will be equally as binding and have the full force and effect as though it were copied into these specifications. Such Standards as are mentioned as generally recognized by and available to the trades concerned. The Contractor will refer to Section 01095- Reference Standards and Definitions for locations and address where this information may be obtained. Unless otherwise specifically stated, the standard specifications referred to will be considered as the latest edition and/or revision of such specifications that is in effect on the date of the Invitation for Bids. In case of any conflicts between standard specifications and the written portion of the Specifications, the specifications as actually written herein will govern.

**Article E-3.1 Schedules:**  
**CONTRACTOR'S CONSTRUCTION SCHEDULES**

The Contractor, within ten (10) Calendar days after Notice to Proceed or Contract Award shall prepare and submit for the Program Manager's approval a Contractor's Construction Schedule for the Work which shall provide for expeditious and practicable execution of the work. This critical path schedule shall contain milestone dates and will be coordinated and approved by the Program Manager, Architect and the Owner prior to the contractor's submittal of the first month's application to the Architect. **The first application for payment will not be processed unless the schedule is approved by the Architect, Program Manager and Owner.**

The Contractor's Construction Schedule will be developed by the Contractor according to the Critical Path Method (hereinafter referred to as CPM). The requirement for CPM is included to ensure adequate planning and execution of the Work. And to assist the Program Manager and Owner in appraising and evaluating the progress of the Work. The Schedule shall be a detailed graphic representation of all significant aspects of the Construction Plan.

The Schedule shall be a computer-produced report utilizing compatible software approved by the Program Manger. The Schedule data shall be categorized in such way as to indicate components of work as directed by the Program Manager and Owner.

The Schedule shall indicate a late completion date for the Project that is no later than the Project's required completion date. All activity dates shall be given in calendar days. For all major equipment and materials fabricated or supplied for this project, the Schedule shall show a sequence of activities including:

- Preparation of Shop Drawings and Sample submissions
- Review of Shop Drawings and Samples
- Shop Fabrication and delivery
- Erection and/or installation
- Project close-out

If the Contractor determines that they can perform work in less time than indicated in the bidding documents, the contractor may schedule the work accordingly, but no claims will be allowed for delay, disruption, acceleration or other costs to the reduced time schedules until times of completion as stated in the Bidding Documents have occurred.

Within five (5) calendar days of submission of the Schedule, the Contractor and his major Subcontractor shall participate in a conference with the Program Manager to review and evaluate the Schedule. Any revisions necessary as a result of this review shall be resubmitted within seven (7) calendar days after the conference. After approval, the Contractor shall provide the following to the Program Manager:

- a. Three (3) copies of the completed Detailed Construction Progress Schedule in a graphic CPM Format
- b. Three (3) copies of the completed Detailed Construction Progress Schedule tabular reports indicating Activity Number, Activity Description, Activity Duration, Early Start, Early Finish, Late Start, Late Finish, and Total Float.
- c. A data diskette of the Detailed Construction Progress Schedule

The approved Detailed Construction Progress Schedule shall then be signed by the Contractor and shall then become the Baseline Schedule which the Contractor shall use in planning, organizing, directing, coordinating, performing and executing the Work. (including all activities of Subcontractors equipment vendors, and suppliers), and shall be the basis for evaluating the Progress of the Work.

**SCHEDULE UPDATES-** The Contractor shall be responsible for providing and submitting to the Program Manager CPM Schedule updated on a **monthly basis** on a date to be determined by the Program Manager. The monthly submission will include items a., b., and c., mentioned in the above article. The Contractor shall also submit to the Program Manager a **weekly “Look Ahead” schedule** prior to the weekly coordination meeting.

The Contractor’s detailed schedule must reflect the normal anticipated adverse weather delays on all weather dependent activities. Anticipated adverse weather conditions will be based on Historical Data for the Augusta, Georgia Airport weather station.

MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS SCHEDULE

JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.
(5)	(5)	(4)	(2)	(3)	(3)	(4)	(3)	(3)	(3)	(3)	(5)

The sequencing and duration of activities within the Schedule shall indicate the amount of float. Float is defined as the amount of time between the Early Dates and the Late Dates of each activity or sequence of activities. Total float is defined as the amount of time any given activity or path of activities may be delayed before the project completion is affected. Float time will not be for the exclusive use of the Contractor, but will be used in the best interest of the completion of the Project within the specified time frame.

Extensions of time for performance or manpower will be granted only to extent that approved changes and/or unusual adverse weather and force majeure exceeds the total float in the affected activity or path of activities at the time approval was issued for the change.

**Five (5) calendar days prior to the date of each Contractor’s Application for Payment** the Contractor’s Project Manager and Superintendent shall meet with the Program Manager at the job site to review actual progress on the Work. At that meeting, unless excluded from the Scope of Work, the Contractor shall provide the following written reports:

1. Progress Report: It will show the activities, or portions of activities, completed during the reporting period, and the progress along the critical path in terms of days ahead or days behind. The Progress Report shall also contain a narrative report which shall include a description of problem areas, current and anticipated delaying factors and their impact, an explanation of corrective action to be taken and any proposed logic for a Recovery Schedule. In preparing each Progress Report, the Contractor is required to meet with all concerned Subcontractors and suppliers whose work is described in, affected by, or related to the Progress Report.
2. Schedule Report: It shall include the following minimum information for each activity and should be sorted by activity, remaining float (from the least to the most) and late start date (in chronological order):
  - a: Activity Number
  - b: Activity Description
  - c: Estimated Duration in Days
  - d: Early and Late Start Dates
  - e: Early and Late Finish Dates
  - f: Percentage Completion of Duration
  - g: Remaining Float/Days Behind Schedule

3. Preliminary Contractor's Application for Payment. Contractor, Architect and Owner, at this time will review preliminary Application for Payment and approve this preliminary request prior to Contractor finalizing formal monthly Application for Payment.

**Monthly Applications for Payment will NOT BE REVIEWED OR PROCESSED without an updated construction schedule reflecting adjustments to contract time, individual values noted on the schedule and projected billings.**

In all of the foregoing reports, actual start and finish dates should be indicated for each activity that has started or finished. Completed activities shall be omitted from Remaining Float and Late Start sorts.

If at any time during the prosecution of the Work any of the following conditions should exist, the Owner and/or Program Manager may require that the Contractor, at no extra cost to the Owner, prepare and implement a Recovery Schedule to explain and display how he intends to regain compliance with the Detailed Construction Progress Schedule during the immediate subsequent pay period. Notwithstanding the above, the Contractor's responsibilities hereunder shall be limited to critical path activities and all designated Milestone dates or activities.

- a. Should the Contractor's Daily Reports or Progress Reports indicate that in the opinion of the Program Manager a Recovery Schedule is required.
- b. Should the Detailed Construction Progress Schedule and Schedule Report sorted by Early Finish show the Contractor to be seven (7) or more days behind schedule on critical path activities or any designated Milestone Dates or activities at any time during construction up to thirty (30) days prior to schedule Substantial Completion
- c. Should the Detailed Construction Progress Schedule and Schedule Report sorted by Early finish show the Contractor to be three (3) or more days behind schedule on critical path activities or any designated Milestone Date or activities at any time during construction up to thirty (30) days prior to schedule Substantial Completion.
- d. Should the Contractor make changes in the logic of the Detailed Construction Progress Schedule which, in the opinion of the Owner and/or the Program Manager are of a major nature.

The Contractor shall do the following after determination of the requirement for a recovery schedule:

- a. Within five (5) calendar days, the Contractor shall complete the Recovery Schedule and submit to the Program manager for review. The Recovery Schedule shall represent the Contractor's best judgment as to how he shall regain compliance with the Detailed Construction Progress Schedule within the immediate subsequent pay period. The Recovery Schedule shall be prepared to a similar level of detail as the Detailed Construction Progress Schedule and shall have a maximum duration of one (1) month which shall coincide with the pay period.
- b. Within three (3) days, the Contractor shall participate in a conference with the Owner and/or Program Manager to review the Recovery Schedule. Any revisions necessary as a result of this review shall be resubmitted within two (2) days of the conference. The revised Recovery Schedule shall then be the Schedule which the Contractor shall use in planning, organizing, directing, coordinating, performing, and executing the Work. (including all activities of subcontractors, equipment vendors, and suppliers) for its one (1) month duration, to regain compliance with the Detailed Construction Progress Schedule.

Seven (7) Calendar days prior to the expiration of the Recovery Schedule the Contractor will meet with the Owner and the Program Manager at the job site to determine the effectiveness of the Recovery Schedule and to determine whether the Contractor has regained compliance with the Detailed Construction Progress Schedule. At the direction of the Owner and/or the Program Manager, one of the following will happen:

- a. If, in the opinion of the Owner and /or the Program Manager, the Contractor is still behind schedule, the Contractor will be required to prepare another Recovery schedule, to take effect during the immediate subsequent pay period.
- b. If, in the opinion of the Owner and /or the Program Manager, the Contractor has sufficiently regained compliance with the Detailed Construction Progress Schedule, the Contractor will return to the use of this schedule.

### **CLAIMS FOR EXTENSION OF THE PROJECT SCHEDULE**

It is understood that the Owner, Program Manager or Architect/Engineer shall not in any event be liable to the Contractor for delays of any kind whatsoever and the Contractor shall be fully responsible for making up lost time of all delays except to the extent that extensions of time are granted.

If the work is delayed as stipulated of the General Conditions, and the Contractor gives **written notice** of a claim for extension of time as stipulated in the General Conditions, time will be extended by such period as the Program Manager may consider reasonable.

No extension of time shall be allowed **unless a claim is presented in writing** to the Program Manager. In case of continued cause of delay, only one claim is necessary.

This shall be construed to release the Contractor from the obligation to perform at his own expense all overtime necessary to maintain the Contract completion date where delay have occurred which are not excused. If the Contractor is delayed by any acts of the Owner, Program Manager, Architect/Engineer is granted an extension of time by the Program Manager the Contractor shall comply with the time extension schedule with no additional compensation from the Owner.

**Contractor must submit written requests for time extensions within five (5) calendar days from the date of cause for such a time extension request.** Any requests beyond this time will be denied by Architect and/or Program Manager.

**Article E-4. Copies of Contract Documents Furnished to Contractor.** - The architect shall furnish to the contractor, free of charge, such number of copies of contract documents as shall be reasonably necessary for the execution of the work.

NOTES:

**Article E-5. Shop Drawings.** - (a) *Submission and Approval.* - The contractor shall submit no shop drawings which do not comply with the contract documents. He shall submit such reasonable number of shop drawings as shall be required by the architect for the work of the various trades, and the architect shall pass upon them, making proper corrections. The contractor shall make any proper corrections required by the architect, file with him two corrected copies, and furnish such other copies as may be needed. The architect's approval of such drawings or schedules shall not relieve the contractor from responsibility for deviations from drawings or specifications now shall it relieve him from the responsibility for errors of any sort in shop drawings or schedules.

(b) *Schedules.* - The contractor and the architect shall jointly prepare a shop drawing schedule, subject to change from time to time in accordance with the progress of the work, fixing the dates for submission of shop drawings by the contractor and for furnishing of approval by the architect. The contractor shall submit in accordance with the schedule, and the architect shall furnish approval in accordance with the schedule. The schedule must be consistent with the construction progress schedule required under Article E-50 of the general conditions.

(c) *Definition.* - Shop drawings are drawings, schedules, data, catalogue cuts, manufacturers' published recommendations, charts, bulletins, brochures, illustrations, circulars, roughing drawings or formulae distributed by contractors, subcontractors, manufacturers, materialmen, or suppliers for use in installing work.

-- [See also Articles E-3(b), E-18 and E-53] --

**Article E-6. Drawings and Specifications at the Site.** - The contractor shall keep at the site one copy of all drawings and specifications in good order and available to the architect and to his representatives.

NOTES:

**Article E-7. Ownership of Drawings and Models.** The Drawings, Designs, Specifications, and other documents prepared by the Architect/Engineer for this Project, including electronic files submitted by the Architect/Engineer to the Owner, shall become the property of the Owner, as payment for such Drawings, Designs, Specifications, and other documents are made to the Architect/Engineer pursuant to this Agreement. However, all reserved rights, including the copyright to such documents shall be retained by the Architect/Engineer. The Architect/Engineer's Drawings, Design, Specifications, and other documents prepared for this Project shall not be used by the Owner or others on other projects, for additions to this Project or for completion of this Project by the Owner or others, without prior written consent to such use is given by the Architect/Engineer, unless the Architect/Engineer is in default under this Agreement.

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**Article E-8. Samples.** - The contractor shall furnish for approval all samples as directed. The work shall be in accordance with approved samples.

NOTES:

**Article E-9. Materials, Appliances, Employees.** - (a) *Payment for.* - Unless otherwise stipulated, the contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary for the execution and completion of the work. [See also Articles E-2 and E-70]

(b) *Quality of materials and workmanship.* - Unless otherwise specified, all materials shall be new, and both workmanship and materials shall be of good quality. The contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials and work. The burden of proof is on the contractor. [See also Article E-13]

(c) *Quality of discipline of employees.* - The contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him. [See also Article E-14]

NOTES:



1. All items will be installed in a workmanlike manner in accordance with the best recognized practice in the field concerned. Manufactured items will be in strict accordance with the manufacturer's printed directions, specifications and/or recommendations for installation of highest quality. All working parts will be properly adjusted after installation and left in perfect working order. Unless otherwise indicated, items exposed to weather or subject to flooding or wetting will be installed so as to shed and not hold water. Items will in all cases be installed plumb and true and/or in proper relation to surrounding materials.

All materials entering into the construction of the building covered by this Contract including but not limited to those mentioned below, will be securely anchored and/or tied together in accordance with the best recognized practice in the field concerned whether shown, specified or not. Ties and anchors will be best quality for the purpose. Wythes of masonry and corners of masonry walls and partitions will be bonded together if possible unless otherwise specifically shown and where not bonded will be secured with appropriate metal ties or anchors. Masonry walls will be anchored to adjacent columns unless otherwise specifically shown. All wood, steel, concrete or other framing will be securely anchored and tied together and to supporting or abutting masonry. All veneers, finishes, and applied items will be securely anchored and tied to the backing material. The purpose of this paragraph is to insure that, except for expansion joints or otherwise where materials are purposely separated, each and every piece of material entering into the building will be bonded, anchored, tied or otherwise secured in place in a permanent manner that will permit expansion, contraction and other minor movements and normal use of the structure without structural features of the building becoming impaired and without any of it's parts becoming loose.

Unless otherwise specifically specified, all items and parts thereof that are made of steel, iron or other ferrous metal that are not galvanized, plated or otherwise specified to be factory finished, will be cleaned and painted with one shop coat of the best quality rust inhibitive metallic primer. After installation, all exposed metal connections and abrasions will be touched up with the same materials as the shop coat and left in good condition for final finishing.

Should a contractor's work requires caulking to complete the finished Product appearance of any item he is installing in the opinion of the Program Manager that Contractor will furnish and install that caulking whether or not called for on plans or in specifications.

**Article E-10. Royalties and Patents.** - The contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the owner harmless from loss on account thereof, except that the owner shall be responsible for all such loss when a particular process or the product of a particular manufacturer or manufacturers is specified, but if the contractor has information that the process or article specified is an infringement of a patent he shall be responsible for such loss unless he promptly gives such information to the owner. [See also Article E-11]

NOTES:

**Article E-11. Surveys, Permits and Regulations.** - (a) *General.* - The Owner shall furnish all surveys unless otherwise specified. Permits and licenses of a temporary nature necessary for the prosecution of the work shall be obtained and paid for by the contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be obtained and paid for by the owner unless otherwise specified. The contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work. If the contractor observes that the drawings or specifications are at variance therewith, he shall promptly notify the owner in writing, and any necessary changes shall be adjusted as provided in the contract for changes in the work. If the contractor performs any work knowing it to be contrary to such laws, ordinances, rules or regulations without such notice to the owner, he shall bear all costs arising therefrom. [See also Articles E-10 and E-42]

(b) *National Plumbing Code.* - The latest edition of the National Plumbing Code with all amendments as of the date of the opening of bids shall govern the installation of all work and is adopted and incorporated into the contract documents and made a part thereof by reference, provided, however: That the drawings and specifications shall be adhered to in all cases where they call for quality of materials, quality of workmanship, or quality of construction which is equal to or in excess of the quality required by the National Plumbing Code and provided also: That there may be no variances from the plans and specifications except to the extent that the said variances shall be necessary in order to comply with the National Plumbing Code. It shall be the responsibility of the contractor to familiarize himself with the requirements of the National Plumbing Code. If there are any express requirements in the plans and/or specifications which are at variance to the National Plumbing Code, all changes in the work necessary to eliminate the said requirements and make the work conform to the National Plumbing Code shall be adjusted as provided in the contract for changes in the work.

(c) *National Electrical Code.* - The latest edition of the National Electrical code with all amendments as of the date of the opening of bids shall govern the installation of all work and is adopted and incorporated into the contract documents and made a part thereof of reference, provided, however: That the drawings and specifications shall be adhered to in all cases where they call for quality of materials, quality of workmanship, or quality of construction which is equal to or in excess of the quality required by the National Electrical Code and provided also: That there may be no variances from the plans and specifications except to the extent that the said variances shall be necessary in order to comply with the National Electrical Code. It shall be the responsibility of the contractor to familiarize himself with the requirements of the National Electrical Code. If there are any express requirements in the plans and/or specifications which are at variance to the National Electrical Code, all changes in the work necessary to eliminate the said requirements and make the work conform to the National Electrical Code shall be adjusted as provided in the contract for changes in the work.

NOTES:

1. The Contractor is solely responsible for the safety of his employees, subcontractors and others in the work area. The Contractor is solely responsible for compliance with all current editions of the State and Federal safety laws, including but not limited to, the latest amendments of the following: Williams-Steigler Occupational Safety and Health Act of 1970, Public Law 91-956, Part 1910-Occupational Safety & Health Standards, Chapter 17 of Title 29 Code of Federal Regulation, Part 1926- Safety & Health regulations for Construction Chapter 17 of Title 29, Code of Federal Regulations

The Contractor will hold weekly meetings with all employees and subcontractors to monitor compliance with all safety regulations. Typed minutes of Safety Meetings will be distributed and filed and will be available for inspection and review.

Contractor will include in his bid all items necessary to comply with OSHA provisions and standards

2. The Contractor agrees to fully comply, when applicable with any and all federal regulatory agency, state or local laws and regulations concerning the transport, storage, and handling of any hazardous substance or materials and to notify the Program Manager three (3) days prior to delivery of any hazardous or harmful substance or materials to the project.

The Contractor also agrees to provide the Program Manager, for the purposes of information, written storage, handling and health instructions and precautions from the manufacturer at the time of notification of delivery. The Contractor will use only competent, knowledgeable workmen trained in the proper handling and storage of these materials and agrees to provide at his expense all safety devices and barriers for his workmen and others as recommended by the manufacturer or that may be deemed necessary by an appropriate governing agency and/or the Program Manager. The Contractor will not under any circumstances dispose of any hazardous substances or containers on the owner's property of facilities. Methods of disposal of these hazardous materials or containers must be in a manner as prescribed by law. The Contractor assumes total liability and responsibility for the handling, storage and disposal of these hazardous materials and indemnifies the Owner, Architect and Program Manager of and from liability, claims, and demands for bodily injury and property damage arising out of the use of the hazardous materials by this Contractor and his agents

The Contractor will ensure a copy of all OSHA Hazardous Communications information is on site and available to the Program Manager

The Contractor will indemnify and hold harmless the Owner, Program Manager and Architect from all claims and citation arising from the Contractor's non-compliance with the safety regulations and laws as listed in paragraph 10.1.1.1, including non-compliance of his employees, his subcontractors and such independent contractors which he may employ.

The Owner reserves the right to perform any work on the site necessary to correct any conditions which pose a hazard to the health or safety of pupils, teachers, administrators or the general public.

**Article E-12. Protection of Work and Property.** - (a) *Duty to Protect Property.* - The contractor shall continuously maintain adequate protection of all his work from damage [See also Article E-24] and shall protect all other property from damage, injury, or loss arising in connection with the work regardless of who may be the owner of said property. He shall make good any such damage, injury, or loss except such as may be directly the result of errors in the contract documents or such as shall be caused directly by agents or employees of the owner. [See also Article E-27]

(b) *Safety Precautions.* - The contractor shall comply with provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work arising out of and in the course of employment on work under the contract. The contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods, and for any damage which may result from their improper construction, maintenance, or operation. He shall erect and properly maintain at all times as required by the conditions and progress of the work proper safeguards for the protection of workmen and the public and shall post danger warnings against any hazards created by the construction operations. He shall designate a responsible member of his organization on the work whose duty shall be the prevention of accidents. In the absence of notice to the contrary, filed with the architect in writing with copy to the owner, this person shall be the superintendent of the contractor. [See also Article E-14]

(c) *Emergencies.* - In an emergency affecting the safety of life or of the work or of adjoining property, the contractor, without special instruction or authorization from the architect or owner, is hereby permitted to act, at his discretion, to prevent such threatened loss or injury. Any remuneration claimed by the contractor on account of emergency work shall be determined in accordance with allowances permitted on force account under Case (c) of Article E-15 of the general conditions.

(d) *Blasting.* - In the absence of an express provision in the contract permitting blasting, there shall be no blasting. If blasting is permitted under the contract and under the law which is applicable to the premises, such blasting shall be done in such manner as to prevent all scattering. (See also Article E-27)

(e) *Rain Water, Surface Water, and Back-up.* - The contractor shall protect all work, including but not limited to excavations and trenches, from rain water, surface water, and back-up of drains and sewers. The contractor shall furnish all labor, pumps, shoring, enclosures, and equipment necessary to protect and to keep the work free of water.

(f) *Underground Gas Pipe Law.* - The contractor by signing the contract acknowledges that he is fully aware of the contents and requirements of *Georgia Laws 1969. Pages 50 and following, and any amendments and regulations pursuant thereto*, (the preceding italicized requirements being hereinafter referred to as the "underground gas pipe law"), and the contractor shall comply therewith. The contractor acknowledges that the contractor is the "person" defined in the above-mentioned underground gas pipe law (a) who will engage in the activities which are regulated thereby, (b) who is required to examine maps filed pursuant thereto, (c) who is required to give written notices to gas companies in accordance therewith, (d) who is required to receive written statements from gas companies as prescribed thereby, and (e) who is to perform and do certain things referred to therein *only* after observing the precautions with respect to underground gas pipes and facilities which are prescribed therein. These provisions of the contract do not repeal the restrictions under Subparagraph (d) of Article E-12 of the general conditions nor do they limit or reduce the duty of the contractor otherwise owed to the owner, to other parties, or to both. The contractor agrees that the foregoing provisions supplement Articles E-12 and E-27 of the general conditions. The contractor agrees and acknowledges that any failure on his part to adhere to the underground gas pipe law shall not only be a violation of law but shall also be a breach of contract and a specific violation of the provision under Article E-12 of the general conditions which pertains to safety precautions.

(g) *High Voltage Act.* - The contractor by signing the contract acknowledges that he is fully aware of the contents and requirements of *Act No. 525, Georgia Laws 1960, Pages 181 and following, any amendments thereto, and Rules and Regulations of the Commissioner of labor pursuant thereto* (the preceding italicized requirements being hereinafter referred to as the "high voltage act"), and the contractor shall comply therewith. The signing of the contract shall also confirm on behalf of the contractor that he

(1) has visited the premises pursuant to Article E-15 (g) of the general conditions and has taken into consideration the location of all electric power lines on and adjacent to all areas onto which the contract documents require or permit the contractor either to work, to store materials, or to stage operations, and

(2) that the contractor has obtained from the local power provider/company of the aforesaid electric power lines advice in writing as to the amount of voltage carried by the aforesaid lines.

The contractor agrees that he is the "person or persons responsible for the work to be done" as referred to in the high voltage act and that accordingly the contractor is solely "responsible for the completion of the safety measures which are required by Section 3 of the high voltage act before proceeding with any work..." The contractor agrees that prior to the completion of precautionary measures required by the high voltage act he will neither bring nor permit the bringing of any equipment onto the site (or onto any area or areas onto which the contract documents require or permit the contractor to work, to store materials, or to stage operations) with which it is possible to come within eight feet of any high voltage line as defined in the high voltage act, and the contractor assumes complete and sole responsibility for any accident or accidents which may occur as a result of contact with a high voltage line or lines locate (a) on the site and (b) on any area or areas onto which the contract documents require or permit the contractor wither to work, to store materials, or to stage operations, or (c) within working distance for equipment or materials being used on (a) and (b) above. These provisions of the contract do not limit or reduce the duty of the contractor otherwise owed to the owner, to other parties, or to both. The contractor agrees and the foregoing provisions supplement Articles E-12 and E-27 of the general conditions. the contractor agrees that the foregoing that any failure on his part to adhere to the high voltage act shall not only be a violation of law but shall also be a breach of contract and a specific violation of the provision under Article E-12 of the general conditions which pertains to safety precautions. The contractor is notified that the Rules and Regulations promulgated by the Commissioner of Labor under date of January 11. 1967, contain a statement under Section 12 that...

"The Division of Inspection of the Department of Labor will act in an advisory capacity to any person, firm, or corporation contemplating any operations near high voltage lines as defined in the Act..."

(h) *Building Construction Safeguards.* - The contractor acknowledges and agrees that he is the person responsible under the law and that he is the person employing or directing others to perform labor within the meaning of Georgia Laws 1967, p. 792, as amended; Ga. Code Ann. Sections 54-406 through 54-411. He acknowledges and agrees likewise that he will comply with the aforesaid law.

NOTES:

**Article E-13. Inspection of Work.** - (a) *Access to Work.* - The architect and his representatives and owner shall at all times have access to the work wherever it is in preparation or progress, and the contractor shall provide proper facilities for such access and for inspection. [See also Article E-9]

(b) *Notice to Architect from Contractor Prior to Covering Work.* - If the specifications, the architect's instructions (either in the specifications or issued later in writing), laws, ordinances or any public authority require any work to be specially tested or approved, the contractor shall give the architect timely notice in writing of its readiness for inspection, and if the inspection is by any authority other than the architect, of the date fixed for such inspection. [See also Article E-58] Inspections by the architect shall be made promptly and where practicable at the source of supply. If any work should be covered without approval or consent of the architect, it must, if required by the architect, be uncovered for examination at the contractor's expense. [See also Article E-58]

(c) *Re-examination or Re-testing of Work Covered Pursuant to Consent of Architect.* - Re-examinations or re-testing of questioned work covered pursuant to consent of the architect may be ordered by the architect, and if so ordered the work must be uncovered by the contractor. If such work be found in accordance with the contract documents, the owner shall pay the cost of re-examination and replacement or of re-testing. If such work be found not in accordance with the contract documents, the subcontractor shall pay such cost unless he shall show that the defect in the work was caused by another sub-contractor, and in that event the owner shall not pay such cost. Contractor shall "back charge" subcontractor, not charge Owner for testing. Cost shall flow to party that caused defective work. Re-examination or re-testing under the terms of Article E-13(c) applies only to work which has been covered with consent of the architect. Work covered without consent of the architect must be uncovered for examination as provide under Article E-13(b).

(d) *Inspection Does Not Relieve Contractor.* - Under the contract documents the contractor has assumed the responsibility of furnishing all services, labor, and materials for the entire work in accordance with such documents. No provisions of this article nor any inspection of the work by the owner, representatives of the owner, resident engineer inspector, clerk-of-the-works, engineers employed by the architect, representatives of the architect, or the architect shall in no way diminish, relieve, or alter said responsibility and undertaking of the contractor; nor shall the omission of any of the foregoing to discover or to bring to the attention of the contractor the existence of any work or materials injured or done not in accordance with said contract documents in any way diminish, relieve, or alter such obligation of the contractor nor shall the aforesaid omission diminish or alter the rights or remedies of the owner as set forth in the contract documents. The resident engineer inspector has no power to make decisions, to accept or reject work, or to consent to the covering of work. The resident engineer inspector owes no duty to the contractor. [See also Articles E-38, E-41, and E-60]

(e) *False Starts.* - In the event notice of readiness pursuant to Article E-13(b), above, shall have been issued prematurely by the contractor, his action shall be deemed to be a "false start", and the contractor shall be liable for the damage resulting from the aforesaid false start, including but not limited to the salary, professional fees, and travel and living expenses of the person or parties inconvenienced by the aforesaid false start. [See also Article E-41 for further example of "false start"]

NOTES:

1. During the progress of the work, the Program Manager and/or the Architect shall inspect the work for conformance to the Contract Documents. Should the inspection reveal work that is not nonconformance with the Contract Documents, and if the nature of the non-conformance so warrants, the Program Manager and/or the Architect will issue a written deficiency list which will stipulate the item or items of work which are non-conforming and will specify a reasonable time for the deficient work to be brought into conformance with the Contract Document.

The Contractor, upon receipt of the deficiency list will implement corrections within the stipulated time, and will notify the Program Manager and/or Architect in writing that the work has been corrected and request inspection.

Upon receipt of the Contractor's request for inspection, the Program Manager and/or Architect will inspect the corrective work, and, if the work is satisfactory, the deficiency list will be rescinded. During the time period that the deficiency list is in effect, the Program Manager and/or Architect may withhold certification for payment as stipulated in subparagraph until the deficiency list is rescinded or, if in the opinion of the Program Manager and/or Architect, the Contractor is making a good faith effort to correct the deficiency..

Until the work is fifty percent (50%) complete, the Owner will pay Ninety percent (90%) of the portion of the amount due on account of progress payments.

At the time the work is fifty (50%) complete and providing that the Contractor is on or ahead of the schedule as determined by the Program Manager and/or Architect and the work is satisfactory and in the absence of other good sufficient reasons, the Contractor may request in writing, and prior to pay application, that the retention be reduced to five percent (5%) of the amount due. Accompanied with the written request of retainage reduction the Contractor shall submit AIA G707 A, Consent of Surety to Reduction in or Partial Release of Retainage, latest edition.

The full contract retainage may be reinstated if the manner and progress of the work does not remain satisfactory to the Program Manager and/or Architect.

**Article E-14. Superintendent and Supervision by Contractor.** - (a) *Superintendent of Contractor.* - The contractor shall keep on his work during its progress and until the final certificate has been executed by the architect a competent superintendent and any necessary assistants, all satisfactory to the architect. The superintendent shall not be changed except with the consent of the architect unless the superintendent proves to be unsatisfactory to the contractor and cease to be in his employ. The superintendent shall represent the contractor in his absence, and all directions given to the superintendent shall be as binding as if given to the contractor. [See also Articles E-9, E-12, E-15(c), and E-60]

(b) *Supervision by Contractor.* - The contractor shall give efficient supervision to the work, using his best skill and attention. He shall carefully study and compare all drawings, specifications, and instructions and shall not be held responsible for their existence or discovery.

-- [See also Articles E-3, E-40, and E-41] --

**NOTES:**

1. The Contractor's Superintendent shall be a competent representative, capable of the following (1)Supervision of tradesmen; (2) Reading and interpreting the Contract Documents; (3) Orderly coordination of this work with the Construction Manager and Architect in the daily execution of the work; (4) Laying out his work; (5) Representing the Contractor with the Owner, Program Manager and Architect in the daily execution of the work; (6) Controlling and establishing good quality in the completed work.

The Contractor's representative shall be the sole supervisor of the Contractor's Labor Force. He shall attend the regularly scheduled progress meeting on-site, keep himself and his company informed of scheduled requirements, safety hazards and general job conditions. He shall plan and pursue the work under his supervision in a professional and expeditious manner.

The Contractor's Superintendent shall be present at the job site whenever work is being performed by his own forces or by his subcontractor's forces.

The Contractor shall submit, prior to starting work on the project, a resume of the superintendent to be employed on the work. Assignments of superintendents shall be subject to approval by the Program Manager/Architect.

The Program Manager/Architect reserves the right to review the performance and competence of the Contractor's Superintendent and the Superintendents of the Contractor's major subcontractors. In the event that the performance of the Contractor's superintendent or the superintendents of the Contractor's major subcontractor's is judged to be detrimental to the project and that the superintendent's removal will be in the best interest of the Owner's, other Contractors, and the project; the Program Manager/Architect shall request the superintendent's removal in writing. The Contractor shall, upon receipt of written notice, remove the superintendent, or request his major subcontractor to remove the superintendent, from the project with in two weeks and provide a suitable replacement.

**Article E-15. Changes in the Work.** - (a) *Owner's Right to Make Changes.* - The owner without invalidating the contract may authorize or order work or may authorize or order changes by altering, adding to, or deducting from the work, the contract sum being adjusted accordingly. Such work is hereinafter designated "change" or "changes". All such changes shall be performed under the conditions of the original contract except that any claim for extension of time caused thereby shall be adjusted at the time of signing of the change order from. [See Article E-1 for definition of the change order form]

(b) *Cost to Owner for Changes.* - The cost to the owner of any change shall be determined in one or more of the following ways:

CASE (a) By estimate and acceptance in a lump sum. Lump Sum must be accompanied by cost breakdown by material, labor and taxes, with overhead and profit broken out so costs and charges can be verified by Architect and/or Program Manager.

CASE (b) By unit prices named in the contract or subsequently agrees upon. Unit prices are net. Neither establishment of unit prices in the contract nor later agreement to unit prices shall entitle the contractor to execute any change under Case (b) prior to issuance of an authorization or order of the owner in writing. The Owner is NOT OBLIGATED to use the unit prices listed on the Contractor's bid form for changes involving changes which may involve unit prices listed on the Contractor's bid form. The Owner may elect to use CASE (a) or CASE (c) to determine the cost of a change if it determines CASE (b) unit costs do not represent a fair or accurate means of determining the cost of a change.

CASE (c) By force account, which is defined as expenditures allowed under Article E-15(h) plus a percentage or percentages as stated under Article E-15(h).



(c) *Changes Forbidden without Consent of Owner.* - Neither the architect nor the contractor shall make any change whatsoever in the work without authorization or order of the owner in writing except in emergency as described hereinbelow. The making of any change without authorization or order of the owner in writing is a breach of contract except in emergency as referred to under Article E-12. In the absence of authorization or order of the owner given in advance in writing (except in emergency as referred to under Article E-12) the contractor shall have no claim for payment, repayment, reimbursement, remittance, remuneration, compensation, profit, cost, overhead expense, loss, expenditure, allowance, charge, demand, hire, wages, salary, tax, cash, assessment, price, money, bill, statement, dues, recovery, restitution, benefit, recoupment, exaction, injury, damages, or time based upon or resulting from any change. [See also Articles E-53 and E-60]

(d) *Notice of demand of contractor for extraordinary remuneration or for damages.* - For a change in the work the contractor shall be entitled to no claim other than or in excess of allowances permitted under Article E-15(h) of the nature of the claim and (b) the owner shall have agreed in writing to the claim. Commencement of execution of a change authorized by the owner in the absence of the aforesaid written notice from the contractor and written agreement to the claim by the owner shall be deemed to be and is conclusive proof that the contractor acknowledges that he makes no claim other than or in excess of allowances permitted under Article E-15(h).

(e) *Subsurface Conditions.* - Material below the surface of the earth is assumed to be earth and other material that can be removed by power shovel or similar equipment. Should conditions encountered below the surface of the ground be at variance to conditions indicated by drawings or specifications [ See also Article E-15(g)], the contract sum shall be adjusted as provided in the contract for changes in the work upon claim by either party made in writing within a reasonable time after the first observance of the conditions, PROVIDED: That the contractor shall in any event give written notice to the Authority before proceeding to execute any change resulting from subsurface conditions and, PROVIDE FURTHER: That, except as referred to hereinbelow the owner shall not be liable to the contractor for any claim occasioned by the aforesaid subsurface conditions except in accordance with and pursuant to authorization of the owner issued in writing prior to commencement of execution of the aforesaid change to which authorization the contractor shall have taken no exception. If exception to the authorization be taken by the contractor the owner may issue an order pursuant to Article E-15(i).

Commencement of execution of work pursuant to Article E-15(i) shall not exclude the recovery of damages by the contractor under other articles of the general conditions, but the cost to the owner for the changes executed pursuant to the aforesaid order shall not exceed the "net allowable expenditures" permitted to the contractor under Article E-15(h) plus the "allowance for overhead and profit" permitted under Article E-15(h).

(f) *Rock.* - If rock, as hereinafter defined, is encountered, no claim for additional compensation for changes shall lie against the owner in the absence of previous authorization by the owner in writing, and the cost to the owner for any changes shall be determined as provided in the contract for changes. CAUTION: No rock for which extra compensation is expected to be received shall be removed except pursuant to and in conformity with a written authorization or order of the owner. No removal of rock as defined herein shall be included in the base bid. *Rock is defined as follows:* (1) Material requiring blasting, (2) boulders of one-half cubic yard or more, (3) material which cannot be removed by power shovel or similar equipment, as stated herein, shall include, but not be limited to the following: For Trenches and Pits: A track-mounted power excavator, equivalent to Caterpillar Model No. 215clc, and rated at not less than 115 HP flywheel power and 32,000 pound drawbar pull and equipped with a short stick and a 42 inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.

For Open Excavations: Caterpillar Model No. 973 or equivalent track-mounted loader, rated at not less than 21 OHP flywheel power and developing minimum of 45,000 pound breakout force (measured in accordance with SAEJ732) or (4) material requiring removal by pneumatic tools or by the use of bars or sledges. Shale, rotten stone, or stratified rock that can be loosened with a pick or removed by power shovel or similar equipment shall not be classified as rock. "Intermittent drilling, blasting, or ripping to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation."

(g) *Existing Conditions.* - The contractor in undertaking the work under this contract is assumed to have visited the premises and to have taken into consideration all conditions which might affect his work. No consideration will be given any claim based on lack of knowledge of existing conditions except where existing conditions are such as cannot be readily ascertained. Any claims relating to conditions which were not readily ascertainable shall be adjusted as provided in the contract for changes in the work

(h) *Cost to Owner, Allowances for Contractor, and Allowable Expenditures.* - In Cases (a) and (c), the "allowance for overhead and profit" combined, included in the total cost to the owner, shall be based upon the following schedule:

- (1) *For the contractor* an allowance for work which he performs with his own forces, not to exceed 20% of his "net additional allowable expenditures", if any, for changes.
- (2) *For a subcontractor* an allowance for work which he performs with his own forces, not to exceed 20% of his "net additional allowable expenditures", if any, for changes. A subcontractor shall receive no allowance for overhead and profit on work not performed by his own forces. Under this contract, the forces of a subcontractor are deemed to be and are the forces of the subcontractor. [See also Articles E-36 and E-37]
- (3) *For the contractor* an allowance for work performed by his subcontractor, not to exceed 7.5% of the amount, if any, due the subcontractor for changes.

The above percentages shall be applied to the "net additional allowable expenditures", if any, as limited and defined herein. If the net difference between "allowable expenditures" and savings results in a decrease in expenditures, the amount of credit allowed the owner shall be the net decrease without any credit for profit and overhead. "Net additional allowable expenditures" as used herein shall mean the difference between all "allowable expenditures" and savings. The term "allowable expenditures" is limited to and defined as items of labor or materials, the use of heavy construction equipment (such as scrapers, backhoes, excavators, bulldozers, draglines, motor graders, and like equipment), and all such items of cost as public liability and workmen's compensation insurance, social security and old age and unemployment insurance, and (in cases where there is an extension of time) *pro rata* expenditures for time of foremen employed in the direct superintendent of productive labor in execution of changes.

All expenditures not included in the term "allowable expenditures" as limited and defined in this article shall be considered as overhead, including, but not limited to, insurance other than that which is mentioned in this article, bond premiums, supervision, travel (meals, transportation, and lodging), superintendent (except *pro rata* time of foremen as referred to herein), timekeepers, clerks, watchmen, hand tools, small tools, incidental job burdens, and office expense. Any other provisions in the contract documents to the contrary notwithstanding, only demonstrable, direct, out-of-pocket expenditures for the changes plus percentages as set forth hereinabove shall be allowable for changes. No wages of a foreman shall be allowable for a change carried on concurrently with contract work unless the claim includes a demand for extension of time caused by the authorizing or ordering of the change.

(i) *Execution of Changes Pursuant to Order.* - In the event neither Case (a), Case (b), nor Case (c) can be mutually agreed upon as the method of determining the cost to the owner for a change, the contractor, provided he receives a written order from the owner, shall proceed on force account under Case (c), and he shall keep and present in such form as the architect may direct a correct account of the expenditures together with vouchers. Allowable expenditures shall in no event exceed current costs for like service and materials, the burden of proof being on the contractor.

(j) *Stipulated Maximum Sum.* - Under Case (b) and Case (c), the owner shall prescribe the limits of any authorization or order for a change by means of an authorization or order in writing stipulating the maximum sum of money committed toward execution of the said change, and the contractor shall have no authority to perform any change which will cost the owner in excess of the stipulated maximum sum. It shall be solely the contractor's responsibility to apply in writing to the owner NOT (repeat NOT) to the architect for an enlargement of the scope of the authorization or order by an increase in the said stipulated maximum sum if during the course of the performance of a change on force account under Case (c) the additional cost of the change to the owner as established in accordance with allowable expenditures and allowances for profit and overhead permitted under Article E-15(h) is approaching the said stipulated maximum sum, and it shall likewise be the responsibility of the contractor to apply for an enlargement of the scope of the authorization or order if the total value of units at any agreed unit price under Case (b) is approaching the said stipulated maximum sum. For changes in the work no claim for payment, repayment, reimbursement, remittance, remuneration, compensation, profit, cost, overhead, expense, loss, expenditure, allowance, charge, demand, hire, wages, salary, tax, cash, assessment, price, money, bill, statement, dues, recovery, restitution, benefit, recoupment, exaction, injury or damages shall lie against the owner for any amount in excess of such amount as shall have been justly agreed to under Case (a) or in excess of such amount as shall have been established as the stipulated maximum sum under Case (b) or Case (c). The cost to the owner for any change in the work, except a change base upon agreed unit prices under Case (b), shall be established in accordance with the schedule of allowances and percentages stipulated under Article E-15(h).

(k) *Breakdown of Expenditures, Cases (a) and (c).* - To accompany all change orders, the contractor shall furnish a breakdown of expenditures for labor and materials by units and quantities in the form prescribed by the owner, and the breakdown shall be accompanied by the following declaration: "I swear and affirm under the penalties for false swearing that the costs shown hereinabove do not exceed current costs for like services or materials and do not exceed the actual costs to the contractor therefore; and that the quantities shown do not exceed actual requirements." For all force account changes the contractor shall promptly and in no event later than thirty (30) days after receipt of written demand therefore pursuant to Article E-15(h) submit to the architect a complete, accurate, and final breakdown and account, together with vouchers, showing all expenditures and percentages allowable under Case (c). For all unit price changes the contractor shall promptly and in no event later than thirty (30) days after receipt of written demand therefore pursuant to Article E-15(h) submit to the architect an accurate account of the quantity of work performed under Case (b). In any case, the architect shall certify to the amount [including under Case (a) and Case (c) the allowance prescribed in the contract for overhead and profit] due the contractor. [See also Articles E-1(l) and E-50]. The contractor shall obtain and furnish as back-up to the contractor's breakdown a separate breakdown for each subcontractor's charges prepared by each subcontractor on the letterhead of the subcontractor and properly signed by the subcontractor.

(l) *Payment on Account.* - If the contractor desires to obtain payment on account before any change in the work has been completed, a change order certified by the architect and signed by the contractor and the owner must have been executed for so much of the change as has been completed at the time of the filing of the claim for payment on account.

(m) *Form and Execution of Change Orders.* - Change orders shall be certified by the architect and signed by the contractor and the owner in accordance with the form of change order prescribed by the owner, copies of which shall be furnished to any bidder upon request. No claim of the contractor for account of a change shall be due nor shall any such claim appear on a periodical estimate or demand for final payment until (1) the claim shall have been certified by the architect and (2) a change order shall have been executed by the contractor and the owner. [See also Article E-1(l)]

(n) *Time of Submission of Claims ["Statement of Claim"].* - Budgeting and cash flow being of material importance to the owner, no claim of the contractor on account of any change or on account of any alleged negligence of the architect or owner whether said claim shall be accrued or prospective, shall be valid unless a "statement of claim" in full accompanied by vouchers and other supporting data shall have been filed with the owner by the contractor not later than thirty (30) days after receipt of written request therefore by the contractor from the owner, time being of the essence. The "statement of claim" shall contain a concise and clear recital of the ground or grounds on the basis of which the claim is asserted, including a designation of the provision or provisions of the contract documents on which the claim is based. The "statement of claim" shall also indicate the dollar amount of the claim. [See also Articles E-16 and E-39(c)]

(o) *Claims distinguished.* - Claims for damages arising out of alleged negligence of the architect or owner as provide for under Article E-16 are distinguished from claims for allowances for changes as provided for under Article E-15. Claims for damages must be filed entirely separately pursuant to Article E-16, and claims for allowances for changes must be filed entirely separately pursuant to Article E-15 unless the contractor and owner agree in writing otherwise. [See also Article E-39(c)]

(p) *Conditions Different from Those Indicated in Contract Documents.* - The parties contemplate delays necessary to complete tests, to redesign, and to perform change order work in the event conditions encountered at the site are different from those indicated in the contract documents. Execution of any change must be authorized. In such event there shall be an adjustment in the contract sum as provided in the contract for changes in the work, but no claim for damages shall lie against the owner for the aforesaid delays. Such delays are not a breach of contract because the parties contemplate such delays as natural and probable consequence of construction operations.

The parties agree that such delays constitute no wrong or injury, create no right to a claim for damages, and are not a ground for claiming extraordinary remuneration.

(q) *Rental Rates and Wage Rates.* - Within five (5) days after execution of the form of agreement and in any event prior to the commencement of any work on the site the contractor shall submit in accordance with the style and format of a specimen to be furnished by the owner (copies of which specimen will be furnished to any bidder on request) for consideration of the owner (1) a proposal for rental rates on heavy construction equipment which shall apply in the event work is performed under Case (c) of Article E-15 and (2) a proposal for wage rates of operating engineers which shall apply in the event of the execution of any work under Case (c) of Article E-15. Under penalty of false swearing a principal of the contracting firm shall certify that the proposal for rental rates and proposal for wage rates do not exceed current costs for like services. The owner will in no event consider a rental rate in excess of 80% are supported by proof satisfactory to the owner that the excess rates are reasonable, the decision of the owner to be final, binding, and conclusive on all parties. Rental rates shall be payable only for the actual time the equipment is required on the site in the reasonable opinion of the architect whose decision in this respect shall be final, binding and conclusive on all parties.

(q) *Unit Prices.* - The term "net" as used in reference to "unit prices" means in respect to all change orders performed in accordance with Case (b) of Article E-15 of the general conditions that the unit prices offered by the contractor and accepted by the owner shall be inclusive of all sums for payment, repayment, reimbursement, remittance, remuneration, compensation, profit, cost, overhead, expense, loss, expenditure, allowance, charge, demand, hire, wages, salary, tax, cash, assessment, price, money, bill, statement, dues, recovery, restitution, benefit, recoupment, exaction, or injury. Upon request of the owner in writing and within such reasonable space of time as the owner shall designate in writing the contractor shall submit for consideration of the owner proposals in writing for unit prices to be applied in the event work is authorized by the owner to be performed under Case (b) of Article E-15. Under penalty of false swearing a principal of the contracting firm shall certify that the unit prices submitted do not exceed current costs for like services or materials.

**NOTES:**

1. In determining the total cost or credit to the Owner resulting from a change in the Work, the allowances for overhead and profit combined, including the total cost to the Owner, shall not exceed the percentage included in the Owner-Contractor agreement.
2. Only fully executed Change Orders, signed by the Contractor, Architect and Owner may be included in the Application for Payment

**Article E-16. Claims.** - (a) *Extra cost.* - If the contractor maintains that any instructions by drawings or otherwise involve extra cost to the owner under this contract, he shall give the owner and the architect written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute any change except in emergency endangering life or property. The allowances to the contractor shall then be as provided under Article E-15. No claim for extra cost shall be valid unless so made.

(b) *Damages.* - If either party to this contract should suffer damage in any manner because of any wrongful act or neglect of the other party or of anyone employed by the other party, then he shall be reimbursed by the other party for such damage. No claim of the contractor for damages shall be valid unless written notice thereof shall have been received by the owner by registered mail within 15 days after occurrence of the event on which the claim is based. [See also Articles E-15, E-39, and E-41]

(c) *Protest.* - All references to arbitration are deleted from the contract documents. Decisions of the architect shall be rendered in all cases as provided for under the general conditions of the contract, but no decision of the architect shall deprive the owner or the contractor of any form of redress which may be available under the laws of the State of Georgia to contracting parties. Any decision of the architect shall be final and binding on the contractor in the absence of written notice of protest from the contractor received by the owner by registered mail within twelve days from the date of receipt of the decision of the architect [See also Articles E-3 and E-39]. The owner shall have twelve days from the date of receipt of a protest within which to investigate and make reply. There is no provision under the contract for execution of work "under protest". A protest must contain (1) the date of the decision of the architect to which exception is taken, (2) a statement of the issue or issues, (3) a citation of the provision or provisions of the contract documents which govern the issue or issues, (4) a summary of the logical principle or principles on which the protest is based, and (5) a summary of the legal grounds for taking exception.

(d) *Shall be based on the Legal Assertions of the Contractor.* - The contractor shall assert claims solely on the basis of (a) principles of logic and (b) principles of law to which the contractor, himself, prescribes. He shall not protest a decision or request a conference on the ground merely that a subcontractor, materialman, or supplier has protested to the general contractor. Accordingly, the contractor shall file no claim nor shall he make a request for a conference with the owner regarding a claim except as it shall be for the purpose of asserting in the exercise of the contractor's best judgment such views, requests, and legal propositions as he deems the contractor is entitled to maintain independently of any right of any subcontractor, materialmen, or supplier against the general contractor. [See also Article E36]

(e) *Conference with the Owner.* - (1) *Effect of.* - The owner has no legal obligation to confer orally with the contractor about the terms of the contract or its performance and may insist that all transactions and all intercourse shall be in writing. Agreement of the owner to confer with a contractor shall not be construed as an offer of the owner to reconsider or alter the owner's policies, practices, procedures, or prior position, not shall such agreement constitute a waiver of any right or defense of the owner. Such a conference is without prejudice to any rights or defenses of the owner. After the conference there will be nothing to confirm since the owner does not engage itself to do or not do a thing by agreeing to confer with the contractor. It is expressly agreed that no conference between the contractor and the owner shall cure any failure of the contractor to give any notice nor shall it cure any breach of any time limit or revive any right in the contractor.

(2) *Conditions precedent to.* - A proposal from the contractor for a conference in respect to (a) dispute, (b) a controversy, or (c) an interpretation or construction of any provision of the contract documents shall contain (a) a statement of the issue or issues, (b) a citation of the provision or provisions of the contract documents which govern the issue or issues, (c) a precise summary of the logical principle or principles on which the issue or issues are based, and (d) a summary of the legal grounds which the contractor takes with respect to the issue or issues.

(3) *Basis for and Terms of.* - All conferences between the owner and the contractor shall be pursuant to, under the terms of, and in accordance with this article of the general conditions.

NOTES:

4. All Claims, disputes and other matters in question between the Contractor and the Owner arising out of, or relating to, this Agreement or the breach therefore in the event that the Contractor and the Owner are unable to resolve the dispute through negotiation, shall be tried before a superior court judge to a jury trial and agrees that the venue of the action will be in Richmond County, Georgia. Any legal proceeding arising out of, or relating to, this agreement shall include, by consolidation, joinder, or joint filing, any additional person or entity to the final resolution of the matter in controversy.

The Contractor hereby further agrees that, should any subcontractor or supplier to the Contractor file a claim concerning any dispute or controversy, which involves the allegations of any acts, error or omissions of the Contractor, then the Contractor shall hold the Owner harmless from any and all costs incurred to, legal costs and attorney's fees and payment of any judgment against the Owner.

Should the Owner employ an attorney to enforce any of the provisions hereof, to protect its interest in any matter arising under this Agreement, or to collect damages for breach of this Agreement, the Contractor agrees to pay the Owner all reasonable costs, charges, expenses and attorney's fees expended or incurred therein.

**Article E-17. Deductions for Uncorrected Work.** - If the architect and owner deem it expedient to correct work injured or done not in accordance with this contract, an equitable deduction from the contract price shall be made therefore; but there is not duty on the part of the owner to accept any work injured or done not in accordance with the methods and materials designated in the contract documents, nor does the contractor demand that there shall be acceptance of work injured or done not in accordance with the methods and materials designated in the contract documents.

NOTES:

**Article E-18. Delays and Extensions of Time.** - (a) *Grounds.* - If the contractor is delayed at any time in the progress of the work by any act or neglect of the owner or the architect, or of any employee of either, or by any separate contractor employed by the owner, or by changes ordered in the work, or by strikes, lockouts, pickets, inclement weather, unforeseeable subsurface conditions, fire, unusual delay in transportation, unavoidable casualties, or any causes beyond the contractor's control, or by any cause which the architect shall decide to justify the delay, then the time of completion shall be extended for such reasonable time as the architect may decide.

The below monthly anticipated adverse weather calendars. Schedule will be used as a guide for the architect's decisions regarding inclement weather.

**MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS SCHEDULE**

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(5)	(5)	(4)	(2)	(3)	(3)	(4)	(3)	(3)	(3)	(3)	(5)

1. The above schedule of anticipated adverse weather will constitute the base line for monthly (or portion thereof) weather time evaluations. Upon acknowledgement of the Notice to Proceed and continuing throughout the contract on a monthly basis, actual adverse weather days above. The term actual adverse weather days shall include days impacted by actual adverse weather days.
2. The number of actual adverse weather days shall be calculated chronologically from the first to the last day in each month. Once the number of actual adverse weather days anticipated in paragraph 1) above has been incurred, the architect will examine any subsequently occurring adverse days to determine whether the contractor is entitled to a time extension. These subsequently occurring adverse weather days must prevent work for 50 percent or more of the contractor's work day and delay work critical to the timely completion of the project. The architect will convert ant delays meeting the above requirements to calendar days and use this as a guide in making decisions regarding request for delays and extension of time for inclement weather.
3. The contractor's schedule must reflect the above anticipated adverse weather delays on all weather dependent activities.

(b) *Filing of Claim* - **No such extension shall be made for delay occurring more than ten (10) days before claim therefore is made in writing to the architect with copy to the owner.** In the case of a continuing cause of delay, only one claim is necessary, but no claim for a continuing delay shall be valid unless the contractor, within ten days from the cessation of the delay, shall have given notice in writing to the architect, with copy to the owner, as to the amount of additional time claimed.

(c) *Delay in Furnishing Drawings.* - [See also Article E-5] If no schedule or agreement stating the dates upon which drawings or approval of shop drawings shall be furnished is made, then no claim for delay shall

be allowed on account of failure of the architect to furnish drawings or approval of shop drawings until two weeks after demand therefore and not then unless such claim be reasonable.

(d) *Damages.* - [See also Article E-15] This article does not exclude the recovery of damages for delay by either party under other provisions in the contract documents.

-- [See also Articles E-1, E-3, E-14, E-26, E-46, and E-50]

NOTES:

1. Historical climatic conditions for the period during which work is to be performed must be considered by the Contractor before the proposal is submitted. Weather conditions shall be a cause for extension of time only if the historical conditions of rain, snow, or ice are exceeded for the period of the work and effect the Critical Path of Construction. Documentation of the presence of unusually severe weather, the extent to which the Contractor was then working, and how the abnormal weather condition had an adverse affect on the scheduled construction must be submitted with any notice request in applying for a time extension due to this cause.
2. No claims for extension of time will be considered when based on delays caused by conditions existing at the time bids were received, and of which the Contractor might be reasonably expected to have full knowledge at the time of bidding, or upon delays caused by failure on the part of the Contractor to anticipate properly the requirements of the work contracted for as to materials, labor and equipment. All claims for extension of time shall be made in writing to the Program Manager and/or Architect.
3. In the event Contractor is delayed at any time in the progress of the work, extension of time shall be the Contractor's **sole remedy** for any such delay (except for Contractor's right to terminate this Agreement pursuant to any application provisions of the Owner-Contractor Agreement), unless the same shall have been caused by acts constituting intentional interference by the Owner with Contractor's performance of the work and where and to the extent that such acts continue after the Contractor's notice to the Owner of such interference. **Written notice** of intentional interference by the Owner must be given within twenty-one (21) days of the occurrence or the claim is waived. The Owner's exercise of any of it's rights under any application provisions of the Owner-Contractor Agreement relating to Changes in the work, regardless of the extent of number of changes in the work, or requirement of correction or re-execution of any of the work, shall not under any circumstances by construed as intentional interference with the Contractor's performance of the work.
4. When the Contract time has been extended for causes as such extension of time shall not be considered as justifying extra compensation to the Contractor for administrative costs.



**Article E-19. Correction of Work Prior to Contractor's Monthly Application for Payment - (a) Orders of Condemnation.** - The contractor shall remove from the premises within the space of time designated in orders of condemnation all work condemned by the architect as failing to conform to the contract, whether incorporated in the work or not, and the contractor shall promptly replace and re-execute the work in accordance with the contract and without expense to the owner and shall bear the expense of making good all work of other contractors destroyed by such removal or replacement. The contractor shall supply any omitted work and perform all unexecuted work within the space of time fixed by the architect in orders of condemnation. [See also Article E-1(i)]

(b) *Remedy of the Owner for Breach of Order of Condemnation* - If the contractor does not make good a deficiency within the reasonable space of time fixed in an order of condemnation, the owner may -

- (1) *Remove the condemned work* and store it at the expense of the contractor. If the contractor does not pay the expenses of such removal and storing within ten days after receipt of written demand of the owner, the owner may upon three days' notice in writing to the contractor sell such materials at private sale or at auction and shall account for the net proceeds thereof after deducting all proper costs incurred by the owner, and
- (2) *Supply omitted work, performs unexecuted work, replace and re-execute work* not done in accordance with the methods and materials designated in the contract documents and deduct the cost thereof from any payment then or thereafter due the contractor, *Provided:* That the architect shall approve the amount charged to the contractor. [See also Article E-21]

The remedies stated in this article are in addition to the remedies otherwise available to the owner, do not exclude such other remedies, and are without prejudice to any other remedies. Time limits stated in orders of condemnation are of the essence of the contract. Unless otherwise agreed to by the owner in writing, the making good of condemned work shall physically commence at the site in not more than seven days after receipt of the order of condemnation except that in case of emergency correction shall physically commence at the site at once and except that the contractor shall in any even physically commence the correction at the site early enough to complete within the space of time allowed in the order of condemnation. The owner will give prompt consideration to reasonable requests for delay in commencement of the making good of orders of condemnation. The making good of condemned work shall be completed within the space of time allowed in the order of condemnation unless the contractor shall have requested from the architect an increase in the amount of time allowed and the architect shall have given notice to the contractor in writing, with copy to the owner, stating the additional amount of time, if any, allowed.

(c) *Notice of Correction from Contractor.* - The contractor shall give prompt notice in writing to the architect, with copy to the owner, upon completion of the correction of any work, the supplying of any omission of any work or materials or the performance of any unexecuted work condemned by the architect. 1] In the absence of such notice, it shall be and is presumed under this contract that there has been no correction, supplying, remedy, or performance of unexecuted work.

NOTES:

**Article E-20. Correction of Work after Final Payment.** - Neither (1) the final certificate, (2) nor any decision of the architect, (3) nor payment, (4) nor any provision in the contract shall relieve the contractor of responsibility for faulty materials, faulty workmanship, or omission of contract work, and he shall remedy any defects or supply any omissions resulting therefrom and pay for any damage to other work resulting therefrom. The Architect shall give notice of observed defects or omissions with reasonable promptness. The contractor shall within the space of time designated in orders of condemnation and without expense to the owner, correct, remedy, replace, re-execute, supply omitted work, or remove from the premises all work condemned by the architect. The contractor shall give prompt notice in writing to the architect, with copy to the owner, upon completion of the supplying of any omitted work or the correction of any work condemned by the architect. In the absence of said notice, it shall be and is presumed under this contract that there has been no correction of the condemned work or supplying of omitted work. If the contractor does not remove, make good the deficiency, correct, or remedy faulty work, or supply any omitted work within the space of time designated in orders of condemnation without expense to the owner, the owner, ten days' notice in writing to the contractor, may remove the work, correct the work, remedy the work or supply omitted work at the expense of the contractor. In case of emergency involving health, safety of property, or safety of life the owner may proceed at once. Correction of defective work executed under the plans and specifications or supplying of omitted work whether or not covered by warranty of a subcontractor or materialman, remains the primary direct responsibility of the contractor. The foregoing obligation of the contractor shall remain in effect until the same shall have been extinguished by operation of the statute of limitations. An additional security for the fulfillment of such obligations, but in no way limiting the same, the contractor warrants and guarantees (1) that all work executed under the plans and specifications shall be free from defects of materials or workmanship for a period of **TWO YEARS** from the date of the final certificate of the architect, and (2) that for not less than **TWO YEARS** from the date of the final certificate of the architect, or for such greater space of time as may have been designated in the specifications, products of manufacturers shall be free from defects of materials or workmanship. Whenever written guaranties or warranties are called for, the contractor shall furnish the aforesaid for such period of time as may be stipulated. The aforesaid instruments shall be in such form as to permit direct enforcement by the owner against any subcontractor, materialman, or manufacturer whose guaranty or warranty is called for, and the contractor agrees that...

- (a) The contractor is jointly and severally liable with such subcontractors, materialmen, or manufacturers.
- (b) The said subcontractors, materialmen, or manufacturers are agents of the contractor for purposes of performance under this article, and the contractor, as principle, ratifies the warranties or guaranties his aforesaid agents by the filing of the aforesaid instruments with the owner. The contractor as principal is liable for the acts or omissions of his agents.
- (c) Service of notice on the contractor that there has been breach of any warranty or guaranty will be sufficient to invoke the terms of the instrument, *Provide:* That the owner shall have furnished the contractor with a copy of notice to be served on the subcontractor, materialman, or manufacturer.
- (d) The contractor will bind his subcontractors, materialmen, and manufacturers to the terms of this article.

The calling for or the furnishing of written warranties or guaranties shall in no way limit the contractual obligation of the contractor as set forth hereinabove. The remedies stated in this article are in addition to the remedies otherwise available to the owner, do not exclude such other remedies, and are without prejudice to any other remedies.

-- [See also Articles E-1(i), E-25, and E-60]

NOTES:

**Article E-21. The Owner's Right to Work.** - If the contractor should neglect to prosecute the work properly or fail to perform any provision of this contract, the owner, after three days' written notice to the contractor may without prejudice to any other remedy he may have make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the contractor. *Provided:* However, that the architect shall approve the amount charged to the contractor [See also Articles E-19(b) (2) and E-22]

NOTES:

1. The Owner reserves the right to perform any work on the site, whether within or without the scope of this contract, necessary to correct any conditions which at the sole discretion of the Owner pose a hazard to the health or safety of pupils, teachers, administrators, or the general public. Such work will only be done on an emergency basis. If practical under the circumstances, the Contractor shall be given notice of any such conditions and given a reasonable opportunity to correct them. If work is done by the Owner pursuant to this subparagraph which is necessitated by any act or failure to act of the Contractor, the costs associated with such work shall be deducted from any sums due the Contractor and a written Change Order adjusting the contract sum will be issued.

**Article E-22. Right of the Owner to Terminate Contract.** - In the event that any of the provisions of this contract are violated by the contractor or by any of his subcontractors, the owner may serve written notice upon the contractor and the surety of the owner's intention to terminate the contract, such notices to contain the reasons for such intention to terminate the contract, and unless within ten (10) days after the serving of such notice upon the contractor, such violation or delay shall cease and satisfactory arrangement of correction be made, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination the owner shall immediately serve notice thereof upon the surety and the contractor, and the surety shall have the right to take over and perform the contract; *Provided, however,* that if the surety does not commence performance thereof within ten (10) days from the date of the mailing to such surety of notice of termination, the owner may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the contractor and the contractor and his surety shall be liable to the owner for any excess cost occasioned the owner thereby, and in such event the owner may take possession of and utilize in completing the work such materials, appliances, and plant as may be on the site of the work and necessary therefore [See Article E-15 for description of "force account"] [See also Article E-26]

NOTES:

**Article E-23. Contractor's Right to Stop Work or Terminate Contract.** - If the work should be stopped under an order of any court or other public authority for a period of ninety (90) days through no act or fault of the contractor or by anyone employed by him, or if the architect should fail to issue any certificate for payment within fourteen days after it is due, or if the owner should fail to pay to the contractor within fourteen days of its maturity and presentation any sum certified by the architect, then the contractor may, upon seven day's written notice to the owner and the architect, stop work or terminate this contract and recover from the owner payment for all work executed and any loss sustained upon any plant or materials and reasonable profit and damages.

NOTES:

**Article E-24. Application for Payments.** - (a) *Periodical Estimates and Receipts.* - The contractor shall submit to the architect in accordance with a form to be supplied by the owner an application (sometime herein designated "periodical estimate") for each payment, and, if requested by the owner or architect,

receipts or other vouchers showing his payments for materials and labor, including payments to subcontractors as required by Article E-37. [See also Articles E-32 and E-50]

(b) *Initial Breakdown and Periodical Payments.* - If payments are made on valuation of work done, such application shall be submitted at least ten days before each payment falls due, and the contractor shall, before the first application, submit to the architect a schedule of values of the various parts of the work, including quantities, aggregating the total sum of the contract, divided in such manner as to facilitate payments to subcontractors in accordance with Article E-37, on a form to be furnished by the owner with a complete breakdown of the contract price so arranged and so itemized as to meet the approval of the program manager and/or architect and, if requested, supported by such evidence as to its correctness as the architect may direct. This schedule designated herein the "initial breakdown" (specimen of which will be supplied to any bidder), when approved by the architect shall be used as a basis for certificates of payment, unless it be found to be in error. In applying for payments, the contractor shall submit a statement based upon this schedule on a periodical estimate form to be supplied by the owner (specimen of which will be supplied to any bidder), and, if requested by the architect or owner, itemized in such form and supported by such evidence as the architect or owner may direct showing the contractor's right to the payment claimed on the periodical estimate.

(c) *Materials stored.* - If payments are made on account of materials delivered and suitably stored at the site but not incorporated in the work, they shall, if required by the owner or the architect, be conditional upon submission by the contractor of bills of sale or such other procedure as will establish the owner's title to such material or otherwise adequately protect the owner's interest. {See also Articles E-28 and E-41] The contractor is responsible for the existence, protection, and, if necessary, replacement of materials until execution of the final certificate of the architect. [See also Articles E-12, E-25, and E-41]

NOTES:

1. The Form of the Application for Payment shall be Georgia State Department of Education Reimbursement Request Form DE 0263, July 1982, with AIA G703, Continuation Sheet, and latest edition.

REIMBURSEMENT REQUEST NO \_\_\_\_\_  
(PROJECT NO. and (NAME) \_\_\_\_\_

**CERTIFICATE OF THE CONTRACTOR OR HIS DULY AUTHORIZED REPRESENTATIVE**

To the best of my knowledge and belief, I certify that all items, units, quantities and prices of work and material shown on this Reimbursement Request No. \_\_\_\_\_ are correct: that all work has been performed and materials supplied in full accordance with the terms and conditions of the contract documents between \_\_\_\_\_

(Owner)

and \_\_\_\_\_ dated \_\_\_\_\_

and all authorized changes thereto; and that the following is a true and correct statement of the contract amount up to and including the last day of the period covered by this estimate and that no part of the "amount due this estimate" have been received.

ORIGINAL CONTRACT AMT. \$ \_\_\_\_\_; ADJUSTED CONTRACT AMT. ---- \$ \_\_\_\_\_

- (a) Total amount earned for work in place (original contract) -----\$ \_\_\_\_\_
- (b) Total amount earned for work in place (change orders) ----- \$ \_\_\_\_\_
- (c) Value of materials stored on site ----- \$ \_\_\_\_\_
- (d) Total amount earned [(a) plus (b) plus (c)] ----- \$ \_\_\_\_\_
- (e) Amount retained (10%) ----- \$ \_\_\_\_\_
- (f) Total earned less retained percentage [(d) minus (e) ] ----- \$ \_\_\_\_\_
- (g) Total previously approved ----- \$ \_\_\_\_\_
- (h) Amount due THIS REQUEST FOR CONTRACTOR [(f) minus (g)] -----\$ \_\_\_\_\_
- (i) Amount due THIS REQUEST FOR ARCHITECT -----\$ \_\_\_\_\_
- (j) TOTAL AMOUNT REQUESTED [(h) plus (i)] -----\$ \_\_\_\_\_

I further certify that all claims outstanding against the undersigned Contractor for labor, materials, and expendable equipment employed in the performance of said contract have been paid in full in accordance with the requirements of said contract, except such outstanding claims as are listed below or on the attached sheet, which statement contains all claims against the contractor which are not yet paid, including all disputed claims and any claims to which the contractor has or will assert any defense.

I further certify that all the materials indicated on this Reimbursement Request as being stored on the site, but not yet incorporated into the building, have been purchased, delivered, and are now stored on the site for future incorporation into the building, and until so incorporated the title to same is, upon payment of this statement, vested in the Owner. Furthermore, the undersigned Contractor assumes full responsibility for the existence, protection, and, if necessary, replacement of the above mentioned materials until the completion of this contract.

Contractor \_\_\_\_\_ By: \_\_\_\_\_

Date \_\_\_\_\_ Title \_\_\_\_\_

**CERTIFICATE OF THE PROGRAM MANAGER**

I certify that I have verified this Reimbursement Request and that to the best of my knowledge and belief it is a true and correct statement of work performed and materials supplied by the Contractor and that the Contractor's certified statement of his account and the amount due him is correct and just and that all work and material in this Reimbursement Request have been performed in full accordance with the terms and conditions of the contract documents and authorized thereto.

Name \_\_\_\_\_ Program Manager Inspector.

Date: \_\_\_\_\_

**CERTIFICATE OF THE SUPERVISING ARCHITECT**

I certify that I have verified this Reimbursement Request and that to the best of my knowledge and belief it is a true and correct statement of work performed and materials supplied by the Contractor and that the Contractor's certified statement of his account and the amount due him is correct and just and that all work and material in this Reimbursement Request have been performed in full accordance with the terms and conditions of the contract documents and authorized thereto.

Name \_\_\_\_\_ Supervising Architect.

Date: \_\_\_\_\_

RICHMOND COUNTY BOARD OF EDUCATION  
 FACILITIES AND MAINTENANCE DEPARTMENT  
 2956 MIKE PADGETT HWY  
 AUGUSTA, GEORGIA 30906

**WORK PERFORMED TO DATE**

In support of Periodical Estimate for Partial Payment No. \_\_\_\_\_  
 For the Period from \_\_\_\_\_ through \_\_\_\_\_ inclusive.  
 Project No., Improvement No., School \_\_\_\_\_  
 Contractor's Name and Address \_\_\_\_\_

**WORK INCLUDED IN ORIGINAL CONTRACT**

<b>DETAILED ESTIMATE</b>				<b>WORK PERFORMED TO DATE</b>			
Item Number	Number & Kind of Units	Unit Price	Estimated Cost	Number of Units	Amount Earned to Date	Value of Complete Work	Percent Complete
A. Total Amount of Original Contract							
B. Plus or Minus Total Previously Approved C.O.'s No. Inc.							
C. Plus or Minus C.O.'s include. approved during period covered by this estimate							
D. Total Net Adjusted Amount							

SCHEDULE OF CHANGE ORDERS

In support of Reimbursement Request No. \_\_\_\_\_

Project Name \_\_\_\_\_ Period Ending \_\_\_\_\_

Contractor \_\_\_\_\_

CHANGE ORDERS		ADDITIONS			DEDUCTIONS
Number (1)	Date (2)	Authorized Amount (3)	Amount This Period (4)	Completed Previous Periods (5)	Authorized Deductions



**Article E-25. Certificates of Payments.** - (a) *Issuance.* - If the contractor has made application for payment as provided under Article E-24, the architect shall not later than the date when each payment falls due issue to the contractor a certificate for such amount as he decides to be properly due or state in writing his reasons for withholding a certificate.

(b) *Effect.* - No certificate issued nor payment made to the contractor nor partial or entire use or occupancy of the work by the owner shall be an acceptance of any work or materials not in accordance with the contract documents. [See also Article E-20] The making of the final payment shall constitute a waiver of all claims by the owner other than those arising from unsettled liens, from faulty work appearing after final payment, for from requirements of the specifications or drawings. Acceptance of the final payment shall operate as and shall be a release to the owner from all claims of any kind or character under the contract except for such specific amount or amounts as may have been withheld to cover the fair value of any incomplete work which has been certified by the architect under the provision of Paragraph (d) of Article 5 of the form of agreement as incomplete through no fault on the part of the contractor.

(c) *Date and Rate of Payment.* - Progress payments will be made by the owner to the contractor in accordance with Article 4 of the form of agreement. Final payments will be made in accordance with Article 5 of the form of agreement. The date and rate of payment are subject to Article E-26. Sums retained pursuant to the present article are and remain the property of the owner until such time as the contractor shall have become entitled to receive payment for such retainage by (a) furnishing the remainder of the *quid pro quo* under the contract and (b) complying in full with the terms of the contract.

(d) *Interest.* - Should the owner fail to pay the sum named in any certificate of the architect upon demand when due, the contractor shall receive, in addition to the sum named in the certificate, interest thereon at the legal rate in force at the time during construction, not at the place of building, PROVIDED: That the contractor shall have given the owner written notice of the date on which payment was properly due, and no interest shall be payable if the owner makes payment within three days after receipt of the aforesaid notice from the contractor. [See also Articles E-24, E-26, and E-46]

NOTES:

**Article E-26. Payments Withheld.** - The program manager and/or architect may withhold or, on account of subsequently discovered evidence, nullify the whole or a part of any certificate to such extent as may be necessary to protect the owner from loss on account of:

- (a) - Defective work not remedied. [See also Article E-19]
- (b) - Claims filed or reasonable evidence indicating probable filing of claims.
- (c) - Failure of the contractor to make payments properly to subcontractors or for materials or labor, [See also Articles E-9 and E-37]
- (d) - A reasonable doubt that the contract can be completed for the balance then unpaid.
- (e) - Damage to another contractor or to some third party. [See also Article E-12]
- (f) - Failure to supply or update monthly critical path schedule or failure to maintain a rate of progress in accordance with the original construction critical path program schedule. [See also Articles E-1(i), E-25(c), and E-46]
- (g) - Failure to supply enough skilled workmen or proper materials. Failure to supply requested related contract documents, papers, forms, or to carry out contract procedures as outlined in plans and specifications or requested by Program Manager and/or Architect. [See also Articles E-1 and E-19]

When the above grounds are removed, payment shall be made for amounts withheld because of them. At the option of the owner adherence of a periodical estimate. No omission on the part of the owner to exercise the aforesaid option shall be construed to be a waiver of breach of the construction progress schedule of acquiescence therein, and the owner may exercise its option from time to time and as often as may be expedient.

NOTES:

**Article E-27. Insurance and Hazards.** - (a) *Hazards.* - The contractor shall be responsible from the time of his signing the form of agreement or from the time of the beginning of the first work, whichever shall be earlier, for all injury or damage of any kind resulting from the work to persons or property regardless of who may be the owner of the property. [See also Article E-12] In addition to the liability imposed upon the contractor on account of bodily injury (including death) or property damage suffered through the contractor's negligence, which liability is not impaired or otherwise affected hereby, the contractor assumes the obligation to indemnify and hold harmless the Owner and Architect and their officers, agents, employees and representatives from and against any and all claims, damages, law suits, suits judgments, expenses, and costs, including attorney's fees, arising out of or resulting from bodily injury, sickness, disease or death, or to injury to or destruction of property including the loss of use or omission of the Contractor or any subcontractor or anyone directly or indirectly employed by them or anyone for whose acts any of them may be liable, regardless of whether or not such bodily injury, sickness, disease or death or injury to or destruction of property is caused in whole or in part by a party indemnified hereunder.

In any and all claims, demands, or judgments against the Owner or the Architect or any of their officers, agents, employees, or representatives by any employee of the contractor or any subcontractor, the indemnification obligation herein set forth shall not be limited in any way by a limitation on the amount or type of damages, compensation or benefit acts or other employee benefit acts, it being the intent of the parties that the indemnification therein given the owner and the architect shall be full and complete.

(b) *Insurance* - Proof of insurance coverage and furnishing of insurance policies shall be as shown herein below.

(1) *Compliance with Workmen's Compensation Laws.* - The contractor agrees to comply with the provisions of the workmen's compensation laws of the State of Georgia and to require all subcontractors likewise to comply. The contractor agrees that, prior to the beginning of the work by the contractor the contractor will furnish the following to the owner: Certificate from insurance company showing issuance of workmen's compensation coverage for the State of Georgia or a certificate from Georgia Workmen's Compensation Board showing proof of ability to pay compensation directly. The contractor agrees that the foregoing provision respecting workmen's compensation is also applicable to subcontractors.

(2) *Endorsement on Builder's Risk Policy.* - General Contractor shall purchase and maintain during the full course of construction "all-Risk" Builders Risk Insurance Coverage which names the Contractor, Owner, the Architect, and Engineers as co-insured. There shall be attached to and made part of the Insurance Policy for Builder's Risk an endorsement of the insurance company in accordance with the specimen shown below.

(3) *Endorsement of Casualty Policies.* - There shall be attached to and made a part of every CASUALTY INSURANCE POLICY an endorsement of the insurance company in accordance with the specimen shown below:

ENDORSEMENT -- BUILDER'S RISK

Attached to and forming part of Policy No. \_\_\_\_\_ of the  
\_\_\_\_\_  
(Number of Policy)  
\_\_\_\_\_ Insurance Company, issued at  
(Name of Insurance Company)  
its \_\_\_\_\_, \_\_\_\_\_ Agency. Date of Endorsement \_\_\_\_\_  
(City) (State)

No. of (Improvement) (Project) Richmond County Board of Education, , 864 Broad Street, Augusta, Georgia 30901 In consideration of the premium for which the policy is written and proper rate adjustment when applicable, the insurance company agrees as follows:

- Item (1)* Furniture and equipment may be delivered to the insured premises and installed in place ready for use, and said delivery and installation of furniture and equipment shall in no way diminish, change, alter, or otherwise affect the coverage and protection afforded the insured under said policy.
- Item (2)* Occupancy shall in no way diminish, change, alter, or otherwise affect the coverage and protection afforded the insured under said policy. The insured shall give notice to insurance company of any occupancy or partial occupancy.
- Item (3)* The insurance company recognizes the right of the owner of the insured premises to perform other work in connection with construction operations insured under this policy and agrees that performance of other work by the said owner, by agents of the said owner, by the lessee of the owner, by contractors employed by the said owner, or by contractors employed by the lessee of the said owner shall in no way diminish, change, alter, or otherwise affect protection afforded under the said policy.
- Item (4)* This policy shall not be canceled, changed [which includes renewal], allowed to lapse or allowed to expire until ten days after the [see invitation to bid and insert name of owner], Richmond County Board of Education, 864 Broad Street, Augusta, Georgia, 30901, has received written notice thereof as evidenced by return receipt of registered letter. It is agreed that the said notice shall be valid only at to such improvements or projects as shall have been designated by number in said notice and that as to any improvement or project not designated by number in the said notice, coverage shall be continued in full force and effect.
- Item (5)* Any other provisions of the agreement to the contrary notwithstanding, coverage under this policy shall automatically terminate thirty-six months from the date shown below.

The foregoing insurance provisions have been incorporated into by reference and are hereby made a part of insurance policy No. \_\_\_\_\_, this \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_

\_\_\_\_\_  
(Name of Company)  
\_\_\_\_\_

(Signature of Authorized Representative)

(3) Endorsement of Casualty Policies: There shall be attached to and made part of every Casualty Insurance Policy and Endorsement of the insurance company in accordance with the specimen shown below:

**SPECIMEN**  
**ENDORSEMENT -- CASUALTY**

Attached to and forming a part of Policy No. \_\_\_\_\_ of the  
\_\_\_\_\_  
(Number of Policy)  
\_\_\_\_\_ Insurance Company, issued at  
(Name of Insurance Company)  
its \_\_\_\_\_, \_\_\_\_\_ Agency. Date of Endorsement \_\_\_\_\_  
(City) (State)  
No. of (Improvement) (Project) \_\_\_\_\_ .

In consideration of the premium for which the policy is written and proper rate adjustment when applicable, the insurance company agrees as follows:

*Item (1)* This policy shall not be canceled, changed (which includes renewal), allowed to lapse, or allowed to expire until ten days after the (see invitation to bid and insert name of owner), Richmond County Board of Education, 864 Broad Street, Augusta, Georgia 30901, has received written notice thereof as evidenced by return receipt of registered letter or until such time as other valid and effective insurance coverage acceptable in every respect to the owner and providing equal protection called for in the policy shown below shall have been received, accepted, and acknowledged by the owner. It is also agreed that the said notice shall be valid only as to such improvements or projects as shall have been designated by number in said notice and that as to any improvement or project not designated by number in the said notice, coverage shall be continued in full force and effect.

*Item (2)* Any other provisions of the agreement to the contrary notwithstanding, coverage under this policy shall automatically terminate thirty-six months from the date shown below.

The foregoing insurance provisions have been incorporated into by reference and are hereby made a part of insurance policy No. \_\_\_\_\_, this \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_

\_\_\_\_\_  
(Name of Company)

\_\_\_\_\_  
(Signature of Authorized Representative)

(4) *Ratification of Agent's Endorsement.* - In furnishing the insurance policy or in furnishing proof of coverage, as the case may be, the casualty insurance carrier shall upon request submit evidence satisfactory to the owner that the agent of the carrier who executed an endorsement had the authority to make changes in the terms of the insurance policy which are binding on the insurance company.

(5) *Policies, Certificates, Limits and Disposition of Documents.* - The contractor shall obtain at his expense insurance with limits as shown hereinbelow unless the contractor desires to broaden the limits and obtain more protection.

- [1] OWNER'S PROTECTIVE LIABILITY INSURANCE -- Taken out in name of the owner as insured. [See Invitation to Bid for exact legal name of owner.]  
*Bodily injury, including death* - limits of \$300,000.00 for each person and \$500,000.00 for each accident.  
*Property damage* - limits of \$100,000.00 for each accident and \$300,000.00 for the aggregate of operations.  
DISPOSITION: Original policy must be deposited with owner prior to commencement of work.
- [2] CONTRACTOR'S PROTECTIVE LIABILITY INSURANCE - Taken out in the name of the contractor.  
*Bodily injury, including death* - limits of \$300,000.00 for each person and \$500,000.00 for each accident.  
*Property damage* - limits of \$100,000.00 for each accident and \$300,000.00 for the aggregate of operations.  
DISPOSITION: Certificate of insurance must be sent to owner prior to commencement of work.
- [3] CONTRACTOR'S PUBLIC LIABILITY INSURANCE - Taken out in the name of the contractor.  
*Bodily injury, including death* - limits of \$300,000.00 for each person and \$500,000.00 for each accident.  
*Property damage* - limits of \$100,000.00 for each accident and \$300,000.00 for the aggregate of operations.  
DISPOSITION: Certificate of insurance must be sent to owner prior to commencement of work.
- [4] BUILDER'S RISK INSURANCE - Payable to the contractor and owner, as their interests may appear, upon the entire structure and upon all materials in or adjacent thereto which are to be made a part of the insured structure to 100% of the insurable value thereof covering fire, extended coverage, vandalism and malicious mischief.  
DISPOSITION: Original policy must be deposited with owner prior to commencement of work.

(6) *Acceptability of Insurers to Owner.* - No insurance will be acceptable unless written by a company licensed by the State Insurance Commissioner to do business in Georgia at the time the policy is issued, and the company must in addition be acceptable to the owner. To avoid inconvenience, any general contractor or subcontractor must get in touch with the owner to determine whether the insurance companies he expects to use is or are acceptable to the owner. All policies and certificates must be signed or countersigned, as the case may be, by resident Georgia agents.

(c) *Termination of Obligation to Insure.* - Unless otherwise expressly provided to the contrary, the obligation to insure as prescribed herein shall not terminate until the architect shall have executed the final certificate. [See also Articles E-20, E-24, E-29, and E-71 of general conditions and Article 5 of Form of Agreement between Contractor and Owner].

(d) *Competence of Insurers.* - The Contractor is responsible for any delay resulting from the failure (1) of his insurance carriers and (2) of insurance carriers of his subcontractors to furnish proof of proper coverage in (1) the prescribed form, (2) the prescribed manner, and (3) in good season.

**NOTES:**

1. The Contractor shall furnish six (6) copies of certificate of insurance which shall specifically set forth evidence of all coverage required. The form of the certificate shall be AIA Document G705 or the Accord Form. The Contractor shall furnish copies of any endorsements that are subsequently issued amending coverage or limits. This policy is to include the clause, "The policies herein referenced to are not cancelable or subject to change of coverage by the insurer unless Hanscomb/GMK has received ten (10) days written notice as evidenced by return receipt of registered or certified letter."
2. Property insurance on the entire project to cover risks of direct physical loss subject to policy conditions and exclusions ("all-risks coverage") to the full insurable value therefore shall be carried by the Contractor, and a certificate of compliance shall be furnished through the Program Manager. This insurance shall have a \$1000 "deductible" on any insured loss and that the amount of this deductible and any other losses not specifically covered under the Owner's policy shall be borne by the General Contractor and/or his subcontractors. Specifically that the insurance does not cover any loss from theft or burglary, nor does it cover loss of any tools, equipment, scaffolding, staging, towers, forms, machinery, etc. owned or rented by the prime contractors, or subcontractors which are not intended to become a part of the project; but does cover damage to the building of contents because of theft or burglary
3. The General Contractor and/or his subcontractors must report any loss to the Owner (who in turn will notify the Insurance Agency as soon as the loss occurs in order that damage be assessed before job conditions are disturbed. Formal claims against this policy should be submitted within 14 days after occurrence.

**Article E-28. Affidavits.** - Before receiving retainage [See also E-24 and E-32] the contractor will be required to furnish non-influence affidavit and statutory affidavit in the exact form as shown hereinbelow:

**SPECIMEN**

NON-INFLUENCE AFFIDAVIT

COUNTY OF \_\_\_\_\_

STATE OF \_\_\_\_\_

I do solemnly swear on my oath that as to the contract dated \_\_\_\_\_, 19 \_\_\_\_\_,

between \_\_\_\_\_ and the [insert name of owner]

I have no knowledge of the exertion of any influence or the attempted exertion of any influence on the firm on behalf of which this affidavit is made in any way, manner, or form in the purchase of materials, equipment, or other items involved in construction, manufacture, or employment of labor under the aforesaid contract by any employee, officer, or agent of [insert name of owner], or any person connected with the State Government of Georgia in any way whatsoever.

This \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_ .

\_\_\_\_\_  
Signature (L.S.)

\_\_\_\_\_  
Title

\_\_\_\_\_  
Firm

COUNTY OF \_\_\_\_\_

STATE OF \_\_\_\_\_

Personally before me, the undersigned authority, appeared \_\_\_\_\_,  
who is known to me to be an official of the firm of \_\_\_\_\_, who,  
after being duly sworn, stated on his oath that he had read the above statement and that the same is true  
and correct.

\_\_\_\_\_  
Notary Public

My commission expires \_\_\_\_\_

This \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_

**LIEN RELEASE FORM**

COUNTY OF \_\_\_\_\_  
STATE OF \_\_\_\_\_  
FROM \_\_\_\_\_

(Contractor)

To: [insert name of owner], Owner  
Contract entered into the \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_, between  
the above-mentioned parties for the construction of a \_\_\_\_\_  
at \_\_\_\_\_

**KNOW ALL MEN BY THESE PRESENTS:**

1. The undersigned hereby certifies that all work required under the above contract has been performed in accordance with the terms thereof, that all materialmen, subcontractors, mechanics, and laborers, have been paid and satisfied in full, and that there are no outstanding claims of any character (including disputed claims or any claims to which the contractor has or will assert any defense) arising out of the performance of the contract which have not been paid and satisfied in full except as listed hereinbelow:  
[Instructions - ENTER THE WORD "NONE" OR LIST THE NAMES OF CLAIMANTS AND THE AMOUNT CLAIMED BY EACH]

2. The undersigned further certifies that to the best of his knowledge and belief there are no unsatisfied claims for damages resulting from injury or death to any employees, subcontractors, or the public at large arising out of the performance of the contract, or any suits or claims for any other damage of any kind, nature, or description which might constitute a lien upon the property of the owner.

3. The undersigned makes this affidavit for the purpose of receiving final payment in full settlement of all claims against the owner arising under or by virtue of the contract, and acceptance of such payment is acknowledged as a release of the owner from any and all claims arising under of by virtue of the contract.

This \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Firm

COUNTY OF \_\_\_\_\_  
STATE OF \_\_\_\_\_

Personally before me, the undersigned authority, appeared \_\_\_\_\_,  
who is known to me to be an official of the firm of \_\_\_\_\_, who,  
after being duly sworn, stated on his oath that he had read the above statement and that the same is true  
and correct.

\_\_\_\_\_  
Notary Public

\_\_\_\_\_  
My commission expires



This \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_

**Article E-29.** - Omitted

**Article E-30. Performance Bond and Payment Bond.** - The contractor shall furnish both a performance bond and a payment bond (Form No. 160) as set forth hereinbelow. The surety must be one which is licensed to do business in the State of Georgia and the surety must in addition be acceptable to the owner. [NOTE: To avoid inconvenience, the contractor should get in touch with the owner to determine whether the surety he expects to use is acceptable to the owner.]

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That \_\_\_\_\_  
(Legal title and address of the Contractor)

as Principal (hereinafter referred to as "Contractor"), and \_\_\_\_\_

\_\_\_\_\_ (Legal title and address of Surety)

as Surety (hereinafter referred to as "Surety"), are held and firmly bound unto \_\_\_\_\_  
as Oblige (hereinafter referred to as "Owner"), in the amount of \_\_\_\_\_

\_\_\_\_\_ (Insert contract price)

Dollars (\$ \_\_\_\_\_ ), to which payment Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above bounded Principal has entered into a contract with Owner bearing date of \_\_\_\_\_ for \_\_\_\_\_  
(Here insert name of work)

in accordance with drawings and specifications prepared by \_\_\_\_\_  
(Here insert full name and title)

which said contract is incorporated herein by reference and made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Contractor shall promptly and faithfully perform and comply with the terms and conditions of said contract; and shall indemnify and save harmless the Owner against and from all costs, expenses, damages, injury or loss to which said Owner may be subjected by reason of any wrongdoing, including patent infringement, misconduct, want of care or skill, default or failure of performance on the part of said Principal, his agents, subcontractors or employees, in the execution or performance of said contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

1. The said Surety to this bond, for value received, hereby stipulates and agrees that no change or changes, extension of time or extensions of time, alteration or alterations or addition or additions to the terms of the contract or to the work to be performed thereunder, or the specifications or drawings accompanying same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change or changes, extension of time or extensions of time, alteration or alterations or addition or additions to the terms of the contract or to the work or to the specifications of drawings.
  
2. If pursuant to the contract documents the Contractor shall be declared in default by the Owner under the aforesaid Contract, the Surety shall promptly remedy the default or defaults or shall promptly, time being of the essence. In said notice of election, the Surety shall indicate the date on which the remedy or performance will commence, and it shall then be the duty of the Surety to give prompt notice in writing to the Owner immediately upon completion of (a) the remedy and/or correction of each default, (b) the remedy and/or correction of each item of condemned work, (c) the furnishing of each omitted item of work, and (d) the performance of the contract. The Surety shall not assert solvency of its Principal as justification for its failure to give notice of election or for its failure to promptly remedy the default or defaults or perform the contract.
  
3. Supplementary to and in addition to the foregoing, whenever the Owner shall notify the Surety that the Owner has notice that the Contractor has failed to pay any subcontractor, materialman, or laborer for labor or materials certified by the Contractor as having been paid for by the Contractor, the Surety shall, within 30 days of receipt of such notice, cause to be paid any unpaid amount for such labor or materials.
  
4. It is expressly agreed by the Principal and the Surety that the Owner, if he desires to do so, is at liberty to make inquiries at any time of subcontractors, laborers, materialmen, or other parties concerning the status of payments for labor, materials, or services furnished in the prosecution of the work.
  
5. The Surety agrees that other than as is provided in this bond it may not demand of the Owner that the Owner shall (a) perform any thing or act, (b) give any notice, (c) furnish any clerical assistance, (d) render any service, (e) furnish any paper or documents, or (f) take any other action of any nature or description which is not required of the Owner named herein or the legal successors of the Owner.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_ A.D. 19 \_\_\_\_\_  
IN THE PRESENCE OF:

	_____ (Principal) (SEAL)
	_____ (Title)
	_____ (Surety) (SEAL)
	_____ (Title)

PAYMENT BOND

THIS BOND IS EXECUTED TOGETHER WITH ANOTHER BOND IN FAVOR OF THE OWNER AS OBLIGEE CONDITIONED UPON PERFORMANCE OF THE CONTRACT  
KNOW ALL MEN BY THESE PRESENTS:

That \_\_\_\_\_  
(Legal title and address of the Contractor)

\_\_\_\_\_ as Principal (hereinafter referred to a "Principal"), and \_\_\_\_\_  
(Legal title and address of Surety)

\_\_\_\_\_ as Surety (hereinafter referred to as "Surety"), are held and firmly bound unto \_\_\_\_\_

\_\_\_\_\_ as Obligee (hereinafter referred to as "Owner"), for the use and benefit of claimants defined, hereinafter, in the

amount of \_\_\_\_\_  
(Insert contract price)

Dollars \$ \_\_\_\_\_ ), to which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above bounded Principal has entered into a contract with Owner dated \_\_\_\_\_  
for \_\_\_\_\_  
(Insert here name of work)

in accordance with drawings and specifications prepared by \_\_\_\_\_  
(Insert here full name and title)

which contract is incorporated herein by reference and made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly make a payment to all claimants as hereinafter defined, for all labor and materials supplied in the prosecution of the work provided for in said Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. The said Surety to this bond, for value received, hereby stipulates and agrees that no change or changes, extensions of time or extensions of time, alteration or alterations or addition or additions to the term of the contract affect its obligation on the bond, and it does hereby waive notice of any such change or changes, extension of time or extensions of time, alteration or alterations or addition or additions to the terms of the contract or to the work or to the specifications or drawings.
2. A claimant is defined as any subcontractor and any person supplying labor, materials, machinery, or equipment in the prosecution of the work provided for in said contract.

3. Every person entitled to the protection hereunder and who has not been paid in full for labor or materials furnished in the prosecution of the work referred to in said bond before the expiration of a period of ninety days after the day on which the last of the labor was done or performed by him, or materials or equipment or machinery was furnished or supplied by him for which such claim is made, or when he has completed his subcontract for which claim is made, shall have the right to sue on such payment bond for the amount, or the balance thereof, unpaid at the time of the commencement of such action and to prosecute such action to final execution and judgment for the sum or sums due him; provided, however, that any person having direct contractual relationship with a subcontractor, but no contractual relationship express or implied with the contractor furnishing said payment bond, shall have the right of action upon the said payment bond upon giving written notice to said contractor within ninety days from the day on which such person did or performed the last of the labor, or furnished the last of the materials or machinery or equipment for which such claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished or supplied or for whom the labor was performed or done; provide further that nothing contained herein shall limit the right of action to said 90-day period. Notice may be served by depositing a notice, registered mail, postage prepaid, duly addressed to the contractor at any letter box under the control of the Post Office Department, or notice may be served in any manner in which the sheriffs of Georgia are authorized by law to serve summons or process. Every suit instituted under this section shall be brought in the name of the claimant without the Owner being made a party thereto. The official who has the custody of said bond is authorized and directed to furnish, to any person making application therefore who submits an affidavit that he has supplied labor or materials for such work and payment therefore has been made, or that he is being sued on any such bond, a copy of such bond and the contract for which it is given, certified by the official who has custody of said bond, this copy shall be primary evidence of said bond and contract and shall be admitted in evidence without further proof. Applicants shall pay for such certified copies and such certified statements such fees as the official fixes to cover the cost of preparation thereof, but in no case shall the fee exceed the fees which the clerks of the superior courts are permitted to charge for similar copies.

4. No action can be instituted on this bond after one year from the date of the final certificate of the architect.

5. Further, this bond shall be considered the same as a bond furnished under Section 23-1705 *et seq.*, of the Code of Georgia, as amended, and all provisions of law pertaining to bonds furnished under said Section shall pertain hereto.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_ A.D. 19 \_\_\_\_\_

IN PRESENCE OF:

(SEAL)

\_\_\_\_\_  
(Principal)

\_\_\_\_\_  
(Title)

(SEAL)

\_\_\_\_\_  
(Surety)

\_\_\_\_\_  
(Title)

NOTES:

**Article E-31.** *Omitted.*

NOTES:

**Article E-32. Liens.** - Neither the final payment nor any part of the retained percentage shall become due until the contractor shall deliver to the owner a complete release of all liens or claims arising out of this contract, or receipts in full in place thereof and, if required in either case, an affidavit that so far as he has knowledge or information the releases and receipts include all labor and materials for which a lien or claim could be filed; but the contractor may, if any subcontractor or claimant refuses to furnish a release or receipt in full, furnish a bond satisfactory to the owner to indemnify the owner against any lien or claim. If any lien or claim remains unsatisfied after all payments are made, the contractor shall refund to the owner all moneys that the latter may be compelled to pay in discharging such lien or claim, including all costs and a reasonable attorney's fee [Se also Articles E-24, E-25, and E-28]

NOTES:

**Article E-33. Assignment.** - Neither party to the contract shall assign the contract or sublet it as a whole nor shall the contractor assign any moneys due to become due to him hereunder.

NOTES:

**Article E-34. Mutual Responsibility of Contractors.** - Should the contractor cause damage to any separate contractor on the work the contractor agrees, upon notice, to settle with such contractor by agreement if he will so settle. If such separate contractor sues the owner on account of any damage alleged to have been so sustained, the owner shall notify the contractor who shall defend such proceedings at his own expense, and if any judgment against the owner shall arise therefrom, the contractor shall pay or satisfy it and pay all costs incurred by the owner. [See also Article E-35]

NOTES:

**Article E-35. Separate Contracts.** - (a) *Duty of Contractor to Cooperate with Other Contractors.* - The owner reserves the right to let other contracts in connection with this work. The contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly regulate, schedule, connect, and coordinate his work with theirs.

(b) *Duty of Contractor to Report Defects.* - If any part of the contractor's work depends for proper execution or results upon the work of any other contractor, the contractor shall inspect and promptly report to the architect any defects in such work that render it unsuitable for such proper execution and results. The contractor's failure to inspect and report shall constitute and acceptance of the other contractor's work as fit a proper for the reception of the contractor's work, except as to defects which may develop in the other contractor's work after the execution of the contractor's work.

(c) *Duty of Contractor to Report Conflicts.* - To insure the proper execution of his subsequent work the contractor shall measure work already in place and shall at once report to the architect any discrepancy between the executed work and the drawings or specifications. [See also Article E-40]

(d) *Equipment.* - Article E-35 also applies to installation of loose equipment and fixtures by the owner or a lessee of the owner, PROVIDED: That the architect shall have rendered a decision in writing that no inconvenience to the contractor will result...

-- [See also Article E-34] --

NOTES:

**Article E-36. Subcontractors, Materialmen, Suppliers, and Employees.** - (a) *Submission of list.* - As soon as possible after notice of award of the contract and in any event not later than three days prior to the time fixed in the contract for delivery of the executed form of agreement to the owner, the contractor shall submit in writing to the architect a list of the names of subcontractors the contractor will employ on the work. The list of subcontractors is not submitted for approval but is for the purpose of establishing...

(a) What trades and portions of the work are to be performed under subcontract, and

(b) The names of the parties selected by the contractor to perform work by subcontract, the aforesaid selection being a matter lying solely within the discretion of the contractor.). **Contractor will also provide a list of subcontractors, noting their business trade, estimated value of their work and business classification (MBE/WBE) for the Local Participation Report to the Board.**

(c) *No approval of subcontractors.* - Neither the owner nor the architect undertakes to pass upon, or approve any subcontractor.

(d) *Warranty of contractor.* - The contractor warrants that the subcontractors selected by him are reputable, skilled, reliable, competent, qualified in the trade or field in which they are to perform on the project, and thoroughly familiar with applicable codes.

(e) *Certification on account of.* - The architect shall, on request furnish to any subcontractor, wherever practicable, evidence of the amounts certified on his account.

(f) *Contractor responsible for acts and omissions of subcontractors, materialmen, suppliers, and employers.* - The contractor agrees that he is a fully responsible for the acts and omissions of his subcontractors, materialmen, suppliers, and employees and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him. The failure of a subcontractor, materialman, supplier, or employee to perform shall not be asserted by the contractor as an excuse for any omission from or noncompliance with requirements of the contract; nor shall the contractor be entitled to an extension of time because of failure of a subcontractor, materialman, supplier, or employee to perform unless said failure was a direct result of some delay to the subcontractor, materialman, supplier, or employee of the kind and character described under Article E-18 for which the contractor shall have requested and received an extension of time under the terms of Article E-18 of the general conditions. [See also Article E-37(a) (3)] The subcontracting of work does not relieve the contractor of the full responsibility for the execution of work and for compliance with all requirements of the contract documents. The contractor may not assert negligence, inefficiency, insolvency, bankruptcy, or incompetence of any subcontractor, materialman, supplier, or employee as excuse for the existence of any noncompliance with or omission to fulfill any obligation under the contract either as to timely performance or as to compliance with methods and materials designated in the contract documents; nor shall the contractor assert nonperformance (unless an extension of time shall have been granted pursuant to Article E-18 as referred to hereinabove) of a subcontractor, materialman, supplier, or employee as excuse for the existence of any noncompliance with or omission to fulfill any obligation under the contract either as to timely performance or as to compliance with methods and materials designated in the contract documents.

As to subcontractors, materialmen, suppliers, and employees of the contractor, the doctrine that a principal is liable for the acts and omissions of his agent shall be binding on the contractor in his relationship to the owner, and the contractor may not reverse the aforesaid doctrine by serving as a conduit or agent for his own agent. [See also Article R-16 and condition of payment bond, Article E-30] Any provision in any contract between the contractor and any subcontractor pursuant to which the contractor is obliged to present to the owner any claim of any subcontractor shall be invalid. [See also Article E-37(1)]

(g) *No contract between owner and any subcontractor, materialman, supplier, or employee.* - Nothing contained in the contract documents shall create any contractual relation between the owner and any subcontractor or between the owner and any materialman, supplier, or employee or the contractor or his subcontractors. [See also Articles E-2, E-37, E-45, and E-60]

NOTES:

**Article E-37. Relationship of Contractor and Subcontractors.-** a) *Obligations of Each.*-The contractor agrees to bind every subcontractor agrees to be bound by the terms of the contract documents insofar as they are applicable to his work, including the following provisions of this article:

THE SUBCONTRACTOR AGREES

- (1) To be bound to the contractor by the terms of the contract documents and to assume toward the contractor all the obligations and responsibilities that the contractor by the aforesaid documents assumes toward the owner.
- (2) To submit to the contractor applications for payment in such reasonable time as to enable the contractor to apply for payment under Article E-24 of the general conditions.
- (3) To make all claims for extras, for extensions of time (See Articles E-18 and E-36) or for damages to the contractor in the manner provided in the general conditions for like claims by the contractor upon the owner, except that the time for making claims for extra expense is one week.

THE CONTRACTOR AGREES

- (4) To be bound to the subcontractor by all the obligations that the owner assumes to the contractor under the contract documents.
- (5) To pay the subcontractor upon the payment of certificates issued under the schedule of values described in Article E-24 of the general conditions the amount allowed to the contractor on account of the subcontractor's work to the extent of the subcontractor's interest therein; provided, however, that retainage shall be paid to the subcontractor as provided in the statutory affidavit specified under Article E-28.
- (6) To pay the subcontractor upon the payment of certificates issued otherwise than as in-Subparagraph E-37(a) (5) above in such manner that at all times the subcontractor's total payments shall be as large in proportion to the value of the work done by the subcontractor as the total amount certified to the contractor is to the value of the work done by the subcontractor.

- (7) To pay the subcontractor to such extent as may be provided by the contract documents or the subcontract, if either of these provides for earlier or larger payments than the above.
  - (8) To pay the subcontractor on demand for his work or materials as far as executed and fixed in place, less the retained percentage, at the time the certificate should issue, even though the architect fails to issue it for any cause not the fault of the subcontractor.
  - (9) To pay the subcontractor a just share of any fire insurance money received by the contractor.
  - (10) To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specifically named in the subcontract.
  - (11) That no claim for services rendered or materials furnished by the contractor to the subcontractor shall be valid unless written notice thereof is given by the contractor to the subcontractor during the first ten days of the calendar month following that in which the claim originated.
  - (12) To give the subcontractor an opportunity to be present and to submit evidence in any dispute involving rights of the subcontractor. [See also Article E-36(e)]
- (b) *Owner Not Obligated to any Subcontractor.* -There is no obligation on the part of the owner to pay to or to see to the payment of any sums to any (1) subcontractor, (2) materialman, (3) supplier, (4) laborer, (5) employee, or (6) claimant as defined in the payment bond. (See also Article E-36(d))
- (c) *Incorporation of Terms in Subcontracts.*-The contractor agrees that failure on his part to incorporate in all subcontracts an express provision in accordance with Article E-37(l), above. shall be deemed to be and is a breach of an essential covenant and that in the event of such breach the contractor shall, within five days after demand of the owner, furnish proof in writing that the deficiency has been remedied to the end that (1) the contractor may not maintain that it is beyond his competence to require performance of terms of the contract by a subcontractor and (2) no subcontractor may maintain that he has not assumed toward the contractor all the obligations and responsibilities that the contractor has assumed toward the owner. Failure on the part of a contractor to effect remedy as above within five (5) days after receipt of written demand of the owner shall be *ipso facto* ground for issuance of a declaration of default by the owner.

- [See also Articles E-15, E-34, and E-36]

NOTES:

**Article E-38. Architect.** -- (a) *Supervision* --The architect shall have general supervision and direction of the work except in respect to safety as stated under Article E-12 and except as qualified by Articles E-13 and E-60 of the general conditions. He is the agent of the owner only when in special instances he is authorized in writing by the owner so to act, and in such instances he shall, upon request, show the contractor written authority. He has authority to stop the work whenever such stoppage may be necessary to insure the proper execution of the contract.

(b) *Interpreter and Impartial Judge.*-As the architect is, in the first instance, the interpreter of the conditions of the contract and the judge of its performance, he shall side neither with the owner nor with the contractor but shall use his powers under the contract to enforce its faithful performance by both.



(c) *Succession.*-In case of the termination of the employment of the architect, the owner shall appoint a capable and reputable architect against whom the contractor makes no reasonable objection and whose status under the contract be that of the former architect.

NOTES:

**Article E-39. Architect's Decisions.** - (a) *Promptness.* - The architect shall make decisions with reasonable promptness after presentation of evidence on (1) any claim of the owner or contractor, (2) a demand of the owner or contractor for a decision on any matter relating to the execution of progress of the work, or (3) a demand of the contractor or owner for interpretation of or additional instructions with respect to the contract documents. [See also Articles E-3 and E-16]

(b) *On artistic effect.* - The architect's decisions in matters relating to artistic effect shall be final if within the terms of the contract documents.

(c) *Claims for alleged procrastination.* - No claim for delay to the contractor or for additional expense to the contractor shall be allowed on account of failure of the architect to render decisions, make interpretations, or furnish additional instructions until ten days after receipt of written claim for additional compensation, damages, or extension of time served upon the architect and the owner and not then unless such claim be reasonable. [See also Articles E-3, E-15, and E-16] Architect will reimburse Owner for any damage claim due contractor.

NOTES:

**Article E-40. Measurements and Dimensions.** - Before ordering material or doing work which is dependent upon coordination with building conditions, the contractor shall verify all dimensions, elevations, grades, and pitch by taking measurements at the building and shall be responsible for the correctness of same. No consideration will be given to any claim based on differences between the actual dimensions and those indicated on the drawings. Any discrepancies between the drawings and/or the specifications and the existing conditions shall be referred to the architect for additional instructions before any work affected thereby is begun [See also Articles E-14, E-35(c), and E-40]

NOTES

**Article E-41. Notice of Readiness for Final Inspection.** - When the contractor is ready for a final inspection, he shall give notice to the architect in accordance with Article 5 of the form of agreement with a copy to the owner in the following words:

The work on the contract for the [show name of improvement or project as it appears in the form of agreement] having been fully completed except as stipulated hereinbelow, it is requested that a final inspection be made promptly by the architect in accordance with Article 5 of the form of agreement. The following work is incomplete through no fault of the contractor [list any work which the contractor regards as a proper exception under Subparagraph (d) of Article 5 of the form of agreement] [See Article E-71 for specimen of form of agreement].

No final inspection shall be made until such time as the architect has received a letter in the exact form indicated above and a copy thereof has been received by the owner. In the event the contractor shall have issued the "Notice of Readiness for Final Inspection" prematurely [hereinafter referred to as "false start"] he

shall be liable for the damage resulting from the aforesaid false start including but not limited to the salaries, professional fees, and travel and living expenses of the persons or parties inconvenienced by the aforesaid false start. [See also Article E-16] The contractor acknowledges and agrees that he has an indivisible, indelegable, and intransferrable contractual obligation to the owner to make his own inspections of his own work at all stages of construction; and he shall supervise and superintend performance of the contract in such manner as to enable him to confirm and corroborate at all times that all work has been executed strictly, literally, rigidly, and inflexibly in accordance with the methods and materials designated in the contract documents so that (a) his certifications on periodical estimates shall be true and correct and (b) his notice of readiness for final inspection shall be true and correct. [See also Articles E-13, E-14, E-24, and E-467] Accordingly, the contractor agrees that he may not defend or excuse any deviation from the contract documents on the ground (a) that the deviation was not brought to his attention by another person or party or other persons or parties, or (b) that a subcontractor is or subcontractors are at fault.

NOTES:

**Article E-42. Use of Premises.** - The contractor shall confine his plant, his apparatus, the staging and storage of materials, the operations of his forces, and the work to limits indicated by law, ordinances, permits, or the contract documents and shall not unreasonably encumber the premises with his materials. The contractor shall not load or permit any part of the work to be loaded with weight that will endanger its safety. The contractor shall enforce the architect's instructions regarding signs, advertisements, fires and smoking. [See also Article E-11]

NOTES:

1. Smoking is prohibited except in designated area.

**Article E-43. Cutting, Patching, and Fitting.** - The contractor shall do all cutting, fitting, or patching of his work that may be required to make its several parts come together properly and fit. [See also Articles E-03, E-40, and E-53]

NOTES:

1. All Contractors, subcontractors and material suppliers will be responsible for inspecting all job conditions affecting the installation of an item and taking all field measurements required prior to fabrication of an item to insure that the item concerned will integrate properly with all adjacent materials and fit all other conditions as they exist or will exist in the finished construction. Work in connection with installation of an item will be coordinated with all other affected work and trades. Sleeves, anchors, and other items that must be embodied in or that otherwise affect other portions of the work will be located and set while such portions of the work are in progress.

Each Contractor is responsible for inspecting the work which precedes his work and reporting any deficiencies which will affect his work to the Architect/Program Manager prior to beginning new work. Should a Contractor be required to perform work or apply finished materials, he shall inspect the surfaces or work to receive his materials for any defects, alignment or conditions that may prevent his work from meeting or exceeding the requirements of the Contract Documents. Should the Contractor find by inspection that the surfaces of work are not acceptable to receive his work, he shall notify the Program Manager in writing of the conditions. Should the Contractor fail to

inspect the work or advise the Program Manager and or/Architect, the Contractor then will be held responsible for the resulting damage. Once new work has begun over preceding work, the Architect/Program Manager will note this as the new Contractor's acceptance of all preceding work.

**Article E-44. Cleaning Up.** - The contractor shall at all times keep the premises free from accumulations of waste materials or rubbish caused by his employees or work. At the completion of the work he shall remove all his rubbish from and about the building and all his tools, scaffolding, and surplus materials and shall leave his work "broom-clean" or its equivalent, unless more exactly specified. In case of disputes the owner may remove the rubbish and charge the cost to the contractor as the architect shall determine to be just. [See also Articles E-12 and E-27]

NOTES:

1. General temporary facilities which affect all Contractors are outlined below. Refer to Division I-Section II-Scope of Work for other specific temporary services assigned to each particular Scope of Work.

The Contractor will provide a job telephone for his, the Architect's and the Owner's use for the duration of the project. Each Contractor will provide, or arrange for the use of, a telephone for his own use while on the project.

Each Contractor will provide his own drinking water.

Each Contractor will provide his own storage and office trailers that he deems necessary to carry out his work. All Utilities for Contractor's storage and office trailers, including utility consumption will be the responsibility of each individual Contractor.

The Contractor will provide and maintain lines, batters and permanent reference points. Each Contractor is responsible for and will provide his own layout and will coordinate his layout with the other Contractors.

**The Contractor will broom sweep the building, once a week or more often as required by job conditions and remove trash from building site once per week or as often as needed. The Contractor will assume this responsibility as soon as the roof deck is installed, or demolition has been completed in each portion of the building area.**

**Each Contractor will not allow trash to accumulate and will remove same from work areas at the close of each day. All debris will be disposed of off campus on a weekly basis. Burning of materials on site will not be permitted.**

The Contractor will be responsible for the final clean up of the job for the purpose of readying the project for final Architectural review and Owner Occupancy.

Each Contractor will remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior surfaces of fixtures, hardware, finish surfaces or equipment furnished as part of his Contract prior to final inspection.

**The Contractor will be responsible for operating and maintaining the permanent heating/cooling systems as the Schedule requires for the installation of finishes.**

**Contractor will replace all air conditioning filters with new filters just prior to Owner's occupancy of the building. This is NOT the filters used for operation during finishes and it is NOT the attic stock filters required for turn-over.**

**Article E-45. Specification Arrangement.** - The specifications are separated into numbered and titled divisions for convenience of reference. Neither the owner nor the architect assumes any responsibility for defining the limits of any subcontracts on account of the arrangement of the specifications. Notwithstanding the appearance of such language in the various divisions of the specifications as, "The Plumbing Contractor", "The Electrical Contractor", "The Roofing Contractor", etc., the general contractor is responsible to the owner for the entire contract and the execution of all of the work referred to in the contract documents. No partial sets of bidding documents shall be issued by the architect. [See also Articles E-03, E-2, E-36, and E-37]

NOTES:

**Article E-46. Commencement, Prosecution, and Completion.** - The contractor will be required (a) to commence work under this contract within ten days after date of written notice from the owner to proceed [See Article E-1(j)], (b) to prosecute the work with faithfulness and energy, (c) to install the various parts of the work with equal steps shown on the construction progress schedule and at the same rate shown on the construction progress schedule to be furnished pursuant to Article E-50, and (d) to complete the work within the time stipulated in the proposal form as adjusted by any extensions of time provided for under Articles E-15 and E-18. Commencement of work shall mean actual physical work on the site. [See also Articles E-1(f) and E-1(i)] **In the event the contractor shall be delinquent in respect to compliance with the time limits established in the construction progress schedule, he shall, within seven days after receipt of written demand of the owner, commence working not less than a twelve-hour day and not less than six days a week until such time as he shall have brought the amount of work in place into compliance with the construction progress schedule.** Fulfillment of this requirement as to overtime work (hereinafter referred to as "recovery of lost time required of the contractor for his breach of the covenant as to time") shall not relieve the contractor from liability for breach of the covenant as to time **the contractor shall be entitle to NO claim against the owner** for any payment, repayment, reimbursement, remittance, remuneration, compensation, profit, cost, overhead, expense, loss, expenditure, allowance, charge, demand, hire, wages, salary, tax, cash, assessment, price, money, bill, statement, dues, recovery, restitution, benefit, recoupment, exaction, injury or damages, [See also Articles E-25 and E-26]

NOTES:

**Article E-47. Alternates.** - (1) Deductive alternates may be used to reduce the base bid; if used, deductive alternates will be prioritized and exercised in numerical sequence as used in the bid documents.

(2) Additive alternates may be used; if used they may be exercised in any order.

(3) The Project shall be awarded by the base bid less any deductive alternate selected (if any); plus any Additive alternates selected (if any). To be clear, any deductive alternates and/or additive alternates selected will be used to determine the low bid.. [See also Article C-04(d)]

NOTES:

**Article E-48. CONTRACT CLOSE-OUT**

Comply with requirements stated in Conditions of the Contract.

No provisions of this Section shall in any way relieve the Contractor of completing his work on time.

**PROJECT TERMINATION:**

Contract requirements shall be met with construction activities have successfully produced, in this order, these three terminal activities:

Substantial Completion  
Final Completion  
Final Payment

**PRELIMINARY INSPECTION:**

When the Contractor determines that his work or portions of his work are sufficiently near substantial completion to warrant a preliminary inspection, he shall request in writing to the Architect/Program Manager a preliminary inspection.

At a mutually agreeable time the Architect and/or Program Manager and Contractor shall conduct a preliminary inspection of the work for completeness and conformance to the Contract Documents. A preliminary punch list of incomplete or non-conformance work shall be made by the Contractor and Program Manager and/or Architect.

The Program Manager and/or Architect shall establish a reasonable time period for the completion or correction of all items on the preliminary punch list. Completion or correction of the preliminary punch list will be prerequisite to Architectural observation for Substantial Completion.

**SUBSTANTIAL COMPLETION:**

The Date of Substantial Completion of the work or designated portion thereof is the date certified by the Architect when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy the work or designated portion thereof for the use for which it is intended.

When Contractor considers that the work, or designated portion thereof is substantially complete, and he has completed correction of the items on the preliminary punch list, the Contractor will submit a written notice to the Program Manager and/or Architect stating that the work, or designated portion thereof, is substantially complete and that the Contractor requests inspection of the work.

**In addition to the written notice requesting inspection, the Contractor shall prepare for the Program Manager and/or Architect a list of items which remain incomplete or not corrected. The Contractor's List will include a reason why the item of work is incomplete or not corrected and will give a date when the work will be completed or corrected.**

The Program Manager shall review the Contractor's request and list, consult with the Architect and submit request for Substantial Completion Observation at a mutually agreeable date.

Within a reasonable time after receipt of such notice, Architect, Program Manager and at his option, the Owner, will make an observation to determine the status of completion.

Should Architect determine that the work is not substantially complete:

Architect will promptly notify the Program Manager in writing, giving the reasons for the work not being substantially complete.  
Program Manager shall forward notice to the Contractor.

Contractor shall remedy the deficiencies in the work, and send a second written notice of substantial completion to the Architect, who will forward the notice to the Program Manager.

Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Architect that the work is complete. Architect, if in agreement shall forward to the Program Manager.

When Architect concurs that the work is substantially complete, he will:

Prepare a Certificate of Substantial Completion on AIA Form G704, accompanied by Architect's Punch List of items to be completed or corrected, as verified and amended by the Program Manager.

(Note: Contract responsibilities are not altered by inclusion or omission of required work from the Punch List)

Submit the Certificate to Owner and Program Manager for their written acceptance of the responsibilities assigned to them in the Certificate.

Contractor shall complete or correct all items identified on the Punch List and required by the Contract requirements within time limits established by the Certificate of Substantial Completion.

#### FINAL COMPLETION:

To attain Final SUBSTANTIAL COMPLETION, The Contractor shall complete activities pertaining to Substantial Completion, and complete work on the Punch List. Only the shall he issue written request to the Program Manager and Architect for Final Observation.

When Contractor considers the work is complete, he shall submit written certification to Program Manager and Architect that:

Contract Documents have been reviewed.

Work has been inspected for compliance with Contract Documents.

Work has been completed in accordance with Contract Documents.

Equipment and systems have been tested in the presence of the Owner's representative and are operational.

Work is completed and ready for final observation.

Architect, Program Manager, Contractor and Owner will make an observation to verify the status of completion with reasonable promptness after receipt of such certification.

Should Architect consider that the work is incomplete or defective:

Architect will promptly notify the Program Manager in writing, listing the incomplete or defective work. Program Manager will notify Contractor.

Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Program Manager that the work is complete. Program Manager, if in agreement shall forward to the Architect.

Architect will re-inspect the work.

When the Architect finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make close-out submittals.

**CONTRACTOR'S CLOSE-OUT SUBMITTALS TO ARCHITECT AND/OR PROGRAM MANAGER (See Section G for additional details and requirements):**

Evidence of Payment and Release of liens:

Assurance that unsettled claims will be settled including;

Submission of AIA Document G706, Contractor's Affidavit of Debts and Claims  
Submission of AIA Document G707, Consent of Surety Company to Final Payment  
Submission of AIA Document G706A, Contractor's Affidavit of Release of Liens from:  
Contractor  
Subcontractor  
Materials Suppliers:

Evidence of compliance with requirements of governing authorities:

Certificate of Occupancy  
Certificate of Inspection

Contractor's Written Guarantee on Company letterhead

Project Record Document:

Operating and Maintenance Data, Instructions to Owner's Personnel.

Warranties and Bonds: To requirements of individual sections

Spare Parts and Maintenance Materials: To requirements of individual sections

Clean-up Letter on company letterhead stating project clean-up has been completed and that Contractor has removed all temporary facilities.

Asbestos Letter on company letterhead stating no asbestos containing materials have been installed on the project.

Surveyor's Drawings-

As-Built Drawings to include a CD of the complete drawings, including GPS coordinates for utilities as required by Augusta/Richmond county Utilities and Inspection Department for occupancy.

Certificate of Substantial Completion

Letter from Contractor stating that he has instructed Owner's personnel on use of equipment (E-55)

Test and Balance Reports (Mechanical)

Certificate of Manufacturer for major components (E-67)

List of Subcontractors by Specialty, including address and telephone numbers for warrantee calls

Termite Letter (Bond)

Low Voltage Systems Certification

Statutory Affidavit as included in the Project manual

Non-Influence Affidavit as included in the Project Manual.

**NO FINAL APPLICATIONS FOR PAYMENT WILL BE PROCESSED FOR PAYMENT UNTIL FINAL INSPECTION AND FINAL ACCEPTANCE BY THE ARCHITECT, PROGRAM MANAGER AND OWNER.**

**FINAL ADJUSTMENT OF ACCOUNTS:**

Submit a final statement of accepting to Program Manager

Statement shall reflect all adjustment to the Contract Sum:

The original Contract Sum

Additions and Deductions resulting from

Previous Change Orders

Unit Prices

Deductions for uncorrected work

Deductions for re-inspection payments

Other payments

TOTAL CONTRACT SUM as adjusted.

Previous payment

Sum Remaining Due

Program Manager will prepare a final Change Order, reflecting adjustments to the Contract Sum which were not previously made by Change Orders.

**FINAL APPLICATION FOR PAYMENT:**



Contract shall forward the final Application for Payment to the Architect. The Architect will evaluate the Application and forward to the Program Manager with recommendations in accordance with procedures and requirements stated in the Conditions of the Contract.

Submission of AIA Document G706-Release Liens, AIA Documents G707- Consent of Surety and AIA Document G706 Affidavit of Payment of Debts and Claims are required before the Program Manager will evaluate any final Application for Payment

In the event that the Contractor submits final Application for Payment with the aforementioned required AIA Documents, refer to Section G regarding withholdings. This amount does not include any amount held for change orders pending, back charges, project deficiencies or punch list items.

NOTES:

**Article E-49. Conflicts.** - The following principles shall govern the settlement of disputes which may arise over conflicts in the contract documents: (a) as between figures given on drawings and the scaled measurements, the figures shall govern; (b) as between large-scale drawings and small-scale drawings, the larger scale shall govern, (c) as between drawings and specifications, the requirements of the specifications shall govern; and (d) as between contract, plans and specifications shall be reported to the Architect for his decision. The principles set forth herein shall not alter provisions of Article E-2 of the general conditions. Schedules, lists, indexes, tables, inventories, written instructions, written descriptions, summaries, statements, classifications, specifications, written selections, or written designations although appearing on the drawings are deemed to be and are "specifications" within the meaning of Article E-49

NOTES:

**Article E-50. Progress Reports.** - Within such reasonable space of time as the owner shall designate in writing, the contractor shall submit to the owner such schedule of quantities and costs, construction progress schedules, cash flow schedule showing cash flow projected monthly from job beginning to completion, payrolls, bills, vouchers, correct copies of all subcontracts, statements, reports, correct copies of all agreements, correspondence, and written transactions with the surety on the performance bond which have any relevance to the work, estimates, records, and other data as the owner may request concerning work performed or to be performed under this contract. When requested by the owner, the contractor shall give the owner access to accounts relating to the foregoing.

The above reports shall include but are not limited to (a) written notice of dates by which specified work will have been completed, (b) written notice of dates by which condemned work shall have been made good, (c) written notice that condemned work has been made good, (d) written notice as to the date or dates by which work has not been performed with equal steps and at the same rate required by the construction progress schedule shall have been brought into conformity with the construction progress schedule, (e) date by which any undisputed claim of a subcontractor, materialman, or laborer shall have been paid, (f) written advice regarding the nature and amount of any disputed claim of a subcontractor, materialman, or laborer and (g) information regarding work performed under Case (b) or Case (c) of Article E-15 upon demand of the owner pursuant to Article E-15(k). Prior to submitting the first periodical estimate [See Article E-24], the contractor shall have furnished to the owner and the architect a construction progress schedule in accordance with the style and format of a specimen to be furnished by the owner [copies of which specimen will be furnished to any bidder on request. [See also Articles E-1(i), E-19, E-20, E-26, and E-46]

NOTES:

1. All Contractors will be required to submit weekly Construction Reports by 10:00am Friday to the Program Manager. The report will include the number of men by trade or craft, type and location of

work. It will include Contractors and other information as required by the Program Manager. Each Contractor will use the Program Manager's form.

The Program Manager, on behalf of the Owner, will arrange for, duly notify all affected contractors, establish an agenda, and conduct monthly job meetings during the course of the contract. Each Contractor will be represented at every meeting by a responsible member of his organization.

**Article E-51. Office for Program Manager.** – The program manager will utilize the contractor's jobsite trailer/office for the purposes of holding meetings and reviewing documents. The contractor shall provide a jobsite office that is adequate to house the required project record documents and to have OAC meetings.

NOTES:

**Article E-52. Trading with the State Statute.** - In submitting a proposal, the bidder certifies that the provision of the act entitled "State Employees and Officials - Trading with the State", Georgia Laws 1956, pp. 60 *et seq.*, has been complied with.

NOTES:

**Article E-53. Manufacturer's Recommendations.** - In the event the contract shall require that given work or materials shall be installed in accordance with the manufacturer's recommendations or requirements, the contractor shall obtain for his use at the site in executing the work copies of the bulletin, circular, catalogue, or other publication of the manufacturer bearing the title, number, edition, date, *etc.* [hereinafter referred to as the "doctrine"] designated in the contract. In the event no such designation appears in the contract documents, the contractor shall not proceed with the installation of the work or materials until (1) he shall have requested from the architect in writing (with copy of the request to the owner) additional instructions pursuant to Article E-3 of the general conditions as to title, number, edition, date, *etc.* of the bulletin, circular, catalogue or other publication of the manufacturer which contains the manufacturer's published recommendations or requirements for installation and use of the product and (2) until he shall have received the aforesaid additional instructions. Prior to proceeding with the installation of the said work or materials, the contractor shall obtain for his use at the site in executing the work the "doctrine" designated in the said additional instructions of the architect. The plans and specifications shall be adhered to in all cases where they call for quality of materials, quality of workmanship, or quality of construction which is equal to or in excess of the quality called for in the manufacturer's recommendations or requirements. There may be no deviations from the plans and specifications except to the extent that the said deviations shall be necessary in order to comply with the manufacturer's express recommendations or express requirements. [See also Articles E-5, E-43, E-55, and E-67]

NOTES:

**Article E-54. Keys.** - Keys with tags indicating number and/or description of door or room each key is intended to fit attached to each key, shall be delivered to the owner. Contractor will forward keys to owner with a letter to Architect indicating that the keys given to Owner and person's name accepting keys. Master keys will be hand delivered to Director of Maintenance of Richmond County School District. Contractor shall prepare and furnish with the keys itemized key schedule in quintuplicate listing the door or room number and/or description, serial number or key and number of keys being delivered for each door or lock.

NOTES:

**Article E-55. Operation and Maintenance Data and Instructions.** - Prior to making request for final inspection, the contractor shall put all mechanical systems and equipment into operation and shall make all tests and adjustments. The contractor shall furnish proper instructions to the lessee of the owner in the presence of the architect concerning operation and maintenance of all mechanical and electrical equipment. Equipment, kitchen equipment, fire alarm & life safety systems, intercom, and time clock systems. The contractor shall give notice in writing to the architect with copy to the owner at least fifteen days prior to the date on which it is proposed to commence. The aforesaid notice shall not (repeat NOT) be given to the lessee of the owner. For all items of mechanical or electrical equipment or apparatus installed which require operation or maintenance after occupancy, the contractor shall furnish and deliver to the owner [not (repeat NOT) to the lessee] complete brochures and data as prepared and published by the manufacturers covering details or operation and maintenance. [See also Articles E-53, E-62, and E-67]

**Section G of the Specifications provides detailed requirements for O&M and Close-out documentation requirements.**

**Article E-56. Space Conditions.** - All pipes passing through floors, walls, and ceilings, shall be installed with sufficient space between them to permit installation of pipe insulation and floor, wall, and ceiling plates without cutting of insulation or plates. Roughing dimensions shall be prepared by the contractor to accomplish this requirement. The contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. This provision includes but is not limited to valves, traps, cleanouts, motors, controllers, switchgear, drain points, and fire dampers. If spaces, dimensions, or other design conditions do not permit compliance with the present article, the contractor shall file a demand in writing with the architect for additional instructions pursuant to Article E-3, furnishing a copy of the aforesaid demand to the owner. [See also Articles E-3 and E-40]

NOTES:

**Article E-57. Cash Allowances.** - The contractor shall include in the contract sum all allowances named in the contract documents and shall cause the work thus covered to be done by such contractors and for such sums as the architect may direct, the contract sum being adjusted in conformity therewith. The contractor declares that the contract sum includes such sums for overhead and profit on account of cash allowances as he deems proper. No demand for overhead and profit other than those included in the contract sum shall be allowed. The contractor shall not be required to employ for any such work persons against whom he has a reasonable objection.

NOTES:

1. RELATED DOCUMENTS:  
Drawing and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section

**SUMMARY:**

This section specifies administrative and procedural requirements governing handling and processing allowances. Selected materials and equipment, and in some cases, their installation are shown and specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. Additional requirements if necessary will be issued by Change Order.

Types of allowances required include the following:

- General allowances
- Material allowances
- Unit Cost allowances

Use of allowances for inspection and testing agencies is included in Section "Testing laboratory Services"

Allowance funds will not be used for any work indicated in the Contract Documents to be part of the Base Bid Contract.

When changes in the contract sum (increase or decrease) are based on Allowances, no overhead or profit shall be allowed and allowances are Net.

## 2. SUBMITTALS

For General Allowances, when directed by the Program Manager, submit proposals for work done under the General Allowances. Submit written information a follows:

State proposed amount to be charged against the allowance

Include full backup data such as cost estimates, material breakdowns, subcontractor's letter or proposal or similar information.

Submit this General Allowance Proposal in a single copy to the Program Manager.

For Materials Allowances, submit invoices or delivery slips to indicate actual quantities and cost of materials delivered to the site for use in fulfillment of each materials allowance. Such invoices must be transmitted and approved by the Program Manager prior to billing the applicable invoices against the Materials Allowance amount.

For test Allowances, submit invoices from testing laboratory or from applicable consultant to indicate actual test and inspections performed for use in fulfillment of each testing allowance. Such invoices must be transmitted and approved by the Program Manager prior to billing the applicable invoices against the Testing Allowance amount.

### GENERAL ALLOWANCES

Use the general allowances only as directed for the Owner's purposes, and only by Field Directives issued by the Program Manager which designate amounts to be charged to the allowance. Such work must be approved by the Program Manager and a Field Directives will be issued prior to implementation.

Field Directives authorizing use of funds from general allowances will include the Contractor's related costs. No overhead and profit margins will be allowed as allowances are net.

At project close-out, credit unused amounts remaining in the General Allowance to Owner by Change Order.

### MATERIALS ALLOWANCES

Material allowances will include costs of all materials and applicable sales tax

All labor to install materials purchased under allowance shall be included under Base Bid, and shall not be part of the materials allowance

At the earliest feasible date after Contract award, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed in order to avoid delay in performance of the Work.

When requested by the Program Manager and/or Architect obtain proposals for each allowance for use in making final selections; include recommendations that are relevant to performance of the Work.

Purchase products and systems as selected by the Architect from the designated supplier

#### UNIT COST ALLOWANCES

Perform work based on unit-cost allowances only as directed by Field Directives issued by the Architect which designate amounts to be charged to the allowance. Such work must be approved by the Program Manager and a Field Directives will be issued prior to implementation.

Field Directives authorizing use of funds from the unit-cost allowances will include the Contractor's related costs. No overhead and profit margins will be allowed as allowances are net.

**At Project close-out, credit unused amounts remaining in the unit-cost allowances to Owner by Change Order.**

**Article E-58. Testing Services.** - Laboratories for testing services shall be selected by, engaged by, and responsible to the Owner, *Provided:* That, in the case of tests (a) prescribed in the contract documents or any part thereof, including Article E-13 of the general conditions or (b) requested by the architect. **The Contractor shall coordinate directly with the selected testing agency to schedule testing as required/needed, and provide notification to the architect stating the date and the hour when he will be ready for the test.** Should reinspection's be required by failure of the work to be ready or by failure of the work to meet specifications, the expense of the services of the testing laboratory shall be applied against the contract fees by a credit adjustment to the owner effected by the furnishing of notice to the contractor by the owner accompanied by a copy of the statement for the testing services on the test which failed or for which the contractor was not ready. This article does not apply to verification of design mix on concrete. [See also Articles E-13 and E-65]

**Article E-59. Drilling Samples and Log of Drilling Wells.** - In the event the work includes a drilled well, the contractor shall forward drilling samples to "Ground Water Division: State Department of Mines, Mining, and Geology; 19 Hunter Street; Agriculture Building; Atlanta, Georgia 30303". Notice by contractor (NOT BY SUBCONTRACTOR) concerning shipment must be forwarded to the Ground Water Division setting forth the name and number of the job, and a copy of the notice must be furnished to the resident engineer inspector, architect, and owner. Samples shall be placed in glass jars of one pint size. The jar shall be tightly covered and shall be labeled in ink to show the date and depth at which the samples were taken and the number of the job. At every change of formation the depth and date at which the change occurred and any unusual circumstances during the completion of the work. Satisfactory evidence that samples have been delivered to the Ground Water Division and receipt of the log book shall be conditions precedent to certification of the work for payment.

**Article E-60. Contractor's Warranty as to Performance.** - The contractor warrants that he is familiar with the codes applicable to the work and that he has the skill, knowledge, competence, organization, and plant to execute the work promptly and efficiently in compliance with the requirements of the contract documents. The contractor having the obligation to keep a competent superintendent on the work during its progress, to employ only skilled mechanics, and to enforce strict discipline and good order among his employees, the contractor, himself is responsible for seeing that the work is installed in accordance with the contract documents. Failure or omission on the part of the owner, representatives of the owner, agents of the owner, resident engineer inspector, clerk-of-the-works, engineers employed by the architect, representatives of the architect, or the architect either to discover or to bring to the attention of the contractor any deviation from, omission from, or noncompliance with the contract documents shall not be set up by the contractor as a defense for failure on his part to install the work in accordance with the contract documents or for any other neglect to fulfill requirements of the contract; nor shall the presence of any one, or all, or any of the foregoing at the site or the fact that any one, or all, or any of the foregoing may have examined the work in accordance with the contract documents or for any neglect to fulfill requirements of the contract. No requirement of this contract may be altered or waived except in pursuance of a written order of the owner and in strict accordance with the provisions in the contract for changes in the work. [See also Article E-9, E-13, E-14, E-15, E-20, E-36, E-37, E-38, and E-39]

NOTES:

**Article E-61. Staples Prohibited on Pipe and Ductwork Insulation.** - No staples shall be used in the application of any type of insulation on any time of pipe or in the application of any type of insulation or any type of ductwork.

NOTES:

**Article E-62. Mechanical Systems, Retainage Pending Balance of.** - If the work includes a heating system, there shall be withheld from the retainage of the contractor as an exception under Article 5(d) of the form of agreement [work which is incomplete through no fault on the part of the contractor] one-half of one per cent of the amount shown on the breakdown of the contractor for the heating system until such time as the architect shall have certified that the heating system has been balanced under seasonal weather conditions, *Provided:* That the amount withheld shall in no event be less than \$1,000.00; and if the work includes an air conditioning system, the same provision shall apply to the said air conditioning system. [See also Article E-71 for specimen of form of agreement]

NOTES:

**Article E-63. Hot Water Heaters.** - No plastic dip tubes may be installed in any hot water heater. The dip tube or filler tube for any hot water heater shall be of galvanized steel, brass, copper, or stainless steel pipe. Temperature relief valves or combined temperature and pressure relief valves for any hot water heaters shall be of such design that the water in the hot water tank will not exceed 210 degrees Fahrenheit maximum. Temperature relief valves or combined temperature and pressure relief valves for any hot water heaters shall be set at a pressure not exceeding the rated working pressure of the hot water tank or heater, but in no case in excess of 150 pounds per square inch. If the architect shall have designed work not in compliance with this article, there shall be a change order with an adjustment in the contract as provided in the contract for changes in the work

NOTES:

**Article E-64. Effect of Addenda, Amendments, Bulletins, Deletions, Omissions, and Change Orders.**

- No special implication, interpretation, construction, connotation, denotation, import, or meaning shall be assigned to any provision of the contract documents because of changes created by the issuance of any (1) addendum, (2) amendment, (3) bulletin, (4) notice of deletion, (5) notice of omission, or (6) change order other than the precise meaning that the contract documents have had if the provision thus created had read originally as it reads subsequently to the (1) addendum, (2) amendment, (3) bulletin, (4) notice of deletion, (5) notice of omission, or (6) change order by which it was created.

NOTES:

**Article E-65. Concrete Specifications.** - "Standard Minimum Concrete Specifications", October 1963, adopted jointly by Georgia Branch, the Associated General Contractors of America, and Georgia Ready-Mix Concrete Association are adopted as a minimum requirement, but in the event any other provision of the contract documents provides for materials, conditions, or services which exceed in quality the materials, conditions, or services required under the aforesaid "Standard Minimum Concrete Specifications", October 1963, the higher quality of materials, may be obtained from Georgia Branch, Associated General Contractors of America, 163 Harris Street, N.W., Atlanta, Georgia, without cost. [See also Article E-58]

NOTES:

**Article E-66. House Bill No. 210.** - House Bill No. 210 [Act No. 443] of the General Assembly of Georgia having been signed into law on April 12, 1963, the same is hereby incorporated into the general conditions of the contract as follows:

SECTION 1

No contract for the construction of, addition to, or repair of any facility, the cost of which is borne by the State, or any department, agency, commission, authority, or political subdivision thereof shall be let, unless said contract contains a stipulation therein providing that the contractor or subcontractor shall use exclusively Georgia forest products in construction thereof, when forest products are to be used in such construction, addition of repair, and if Georgia forest products are available.

SECTION 2

The provisions of this Act shall not apply when in conflict with Federal rules and regulations concerning construction.

NOTES:

**Article E-67. Certificates of Manufacturers for Major Components.** - For elevators, moving walks, dumb-waiters, escalators, lifts, major components of air conditioning systems [*i.e.*, cooling towers, compressors, condensers, absorption units, chiller units, fan coil units, air handling units, boilers, base mounted pumps, and temperature controls]; major components of heating systems [*i.e.*, boilers, base mounted pumps, air handling units, unit ventilators, fan coil units, temperature controls, and boiler chemical feed systems]; major components of plumbing systems [*i.e.*, boilers, base mounted pumps, sewage pumps and water treatment systems]; and incinerator systems; start-up, testing, and placing into operation shall be performed by the field representative(s) of the manufacturer(s) in which the manufacturer(s) shall be filed with the owner on the letterhead(s) of the manufacturer(s) in which the manufacturer(s) certifies or certify that "the equipment has been installed in strict compliance with the recommendations of the manufacturer(s) and is operating properly". [See specimen of certificate, Form No. 290 attached hereto] The manufacturer(s) shall list in the certificate the item or items furnished to the job. The date, name, or other positive means of identifying the exact document or documents containing the recommendations of the manufacturer(s) shall be set forth in the certificate. A copy of each of the aforesaid documents shall be attached to the certificate. A specimen of the certificate will be furnished by the owner and shall be adhered to by the manufacturer(s) in preparing the certificate. The contractor expressly agrees that the aforesaid manufacturer(s) is (are) solely the agent(s) of the contractor. The contractor shall coordinate the performance of the aforesaid services and shall, in all cases where the equipment of two or more manufacturer's ties in and functions together require the field representative to perform simultaneously the initial start-up, the testing, and the placing of their equipment into operation. "Start-up" is defined as putting the equipment into action. "Testing" is defined as performing such testing as is stipulated in the contract documents to be performed. "Placing into operation" is defined as operating the equipment for a sufficient period of time for the determination to be made that it is performing properly. [See also Articles E-53 and E-55) *Attachment to Article E-67: Form No. 290 (less enclosure thereto) - Specimen Certificate of Manufacturer.*

NOTES:



**SPECIMEN CERTIFICATE OF MANUFACTURER**

INSTRUCTIONS FOR PREPARATION OF CERTIFICATE: To be acceptable, the certificate must be prepared in the form indicated by this specimen *on the official letterhead of the manufacturer*. No portions of the certificate may be omitted. Attached is a copy of the contract provision under which the certificate is required. The Authority needs only one copy of the certificate. If equipment of a manufacturer is not installed in strict compliance with the recommendations of the manufacturer or if in the design of the work the equipment is not applied in strict compliance with the recommendations of the manufacturer, a letter from the manufacturer should be forwarded to the contractor (with copies to the architect and the owner) setting forth a list of the deviations from the recommendations of the manufacturer and stating what remains to be done in order to bring the work into strict compliance with the recommendations of the manufacturer. (See "Definitions" set forth on the last page of this specimen.) Prior to calling upon the representative of the manufacturer for performance of the services necessary to enable him to execute a certificate in accordance with this specimen, it is the obligation of the contractor to have installed the work in strict compliance with the recommendations of the manufacturer [See Article E-33 of the General Conditions], and it is likewise the obligation of the contractor to have put the equipment in good operating condition in absolute and final readiness for the "start-up", "testing", and "placing into operation" as defined hereinbelow by the representative of the manufacturer. If the contractor has met his obligations as outlined hereinbefore, it would hardly be possible for more than one day of the time of the representative of the manufacturer to be required.

Date: \_\_\_\_\_

Richmond County Board of Education  
2083 Heckle Street  
Augusta, Georgia 30904-4295

Re: Certificate of JOHN DOE CORPORATION that equipment or components furnished by it has [or have, as the case may be] been installed in strict compliance with its recommendations and is [or are, as the case may be] operating properly at IMPROVEMENT OR PROJECT NO.

Gentlemen: \_\_\_\_\_

1. We certify through our duly authorized and acting agent that the following item [or items, as the case may be] furnished by us to the project or improvement named in the caption was [or were, as the case may be] started up, tested, and placed in operation by our authorized field representative on [enter the date on which the field representative performed the start-up, test, and placing into operation] and is [or are, as the case may be] operating properly:

[List the item or items furnished to the job.  
Show catalogue number or numbers.]

2. We certify further that the aforesaid equipment was installed in strict compliance with our recommendations as published by us in the following document [or documents, as the case may be]:

[Insert the date, name, or other positive means of identifying the exact document or documents in which the recommendations for installation and use of the item or items are published.] (\*)

3. A copy of the aforesaid document(s) is (are) attached hereto.

This \_\_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_\_

JOE DOE CORPORATION

By \_\_\_\_\_  
Authorized Representative

(\*) The date *must* be shown

Attachment -- Copy of contract provision -- (Article E-67)]

DEFINITIONS:

1. "Start-up" is defined as putting the equipment into action.
2. "Testing" is defined as performing such testing as is stipulated in the contract documents to be performed.
3. "Placing into operation" is defined as operating the equipment for a sufficient period of time for the determination to be made that it is performing properly.

**Article E-68.** *Omitted.*

NOTES:

**Article E-69. Copies of Notices to Owner.** - Wherever the general conditions provide that a copy of any notice, request, or demand filed with the architect by the contractor shall be furnished to the owner, such notice, request or demand shall not become effective until the owner's copy shall have been received by the owner. No notice in writing or orally to the architect or to the resident engineer inspector is notice to the owner unless copy of the aforesaid notice in writing shall have been properly served upon the owner at the address shown hereinbelow:

Richmond County Board of Education  
864 Broad Street  
Augusta, Georgia 30901

-- [See also Articles E-1(d), E-3, E-15, E-16, E-18, and E-39(c)] --

NOTES:

**Article E-70. Utilities.** - Pending the extension and connection of permanent water and permanent electric power, the contractor shall obtain temporary electric power at his own expense. **In the absence of provisions to the contrary, the contractor shall pay for all utilities services until the final acceptance by Architect and/or Owner has been executed or until the work is occupied, whichever is the earlier.**

[See also Article E-9] If building is phased and portions of the building are occupied by Owner prior to final acceptance of entire structure, the cost of utilities for the occupied portion of the building will be pro-rated based upon the square footage of the building occupied by the Owner.

NOTES:

**Article E-71 Form of Agreement.** - The form of agreement shall be executed on Form No. 418, specimen of which is attached hereto. [See also Article E-1]

*Attachment to Article E-71:* Form No. 418, "FORM OF AGREEMENT BETWEEN CONTRACTOR AND OWNER"

NOTES:

**FORM OF AGREEMENT BETWEEN CONTRACTOR AND OWNER**

THIS AGREEMENT made the \_\_\_\_\_ day of \_\_\_\_\_ in the year Nineteen  
Hundred and \_\_\_\_\_ by and between \_\_\_\_\_

\_\_\_\_\_ hereinafter called the Contractor, and \_\_\_\_\_

\_\_\_\_\_ hereinafter called the owner,

WITNESSETH, That the contractor and the owner for the considerations hereinafter named agree as follows:

1. SCOPE OF THE WORK. - The contractor shall furnish all of the materials and perform all of the work shown on the drawings or described in the specifications entitled \_\_\_\_\_

\_\_\_\_\_ prepared by \_\_\_\_\_ acting as and in these contract documents entitled the architect; and shall do everything required by this agreement, the general conditions of the contract, the specifications or the drawings.

2. TIME OF COMPLETION. - The work to be performed under this contract shall be commenced \_\_\_\_\_ and shall be completed \_\_\_\_\_

3. THE CONTRACT SUM - The owner shall pay the contractor for the performance of the contract, subject to additions and deductions provided therein, in currents funds as follows:

\_\_\_\_\_

4. PROGRESS PAYMENTS. - The owner shall make progress payments on account of the contract as follows: On or about the 25th of each month 90 per cent of the value, based on the contract prices, of labor and materials incorporated in the work and of materials suitably stored at the site thereof up to the 1st say of that month, as estimated by the architect, less the aggregate of previous payments, until one-half of the contract sum is due. Payments will be made between the 15<sup>th</sup> and 20<sup>th</sup> of the following month.

If the work is....

- (a) On or ahead of the constructions progress schedule; and
- (b) There are no breaches of orders of condemnation; and
- (c) There is no delinquency in the filing of the final breakdown and accounting, together with vouchers, on force account work as referred to in Subparagraph (k) and (n) of Article E-15 of the general conditions when one-half of the contract sum is due no further retainage will be withheld by the owner from payments to the contractor unless...

*Event (a)* The percentage of work complete as set forth in Column (8), Line D, of Form 36-3 falls behind the percentage required by the construction progress schedule by as much as 15 per cent; or

*Event (b)* The contractor breaches an order of condemnation; or

*Event (c)* The contractor becomes delinquent in regard to the filing of the final breakdown and accounting, together with vouchers, on force account work as referred to Subparagraphs (k) and (n) of Article E-15 of the general conditions,

in which event or events the owner shall reinstate the 10 percent retainage on all periodical estimates due to be paid while one or more of the events continues to exist. The contractor will be given written notice of the reinstatement of the retainage. If the contractor...

- (a) Recovers all lost time and puts the work back on schedule; and
- (b) Remedies all breaches of orders of condemnation; and
- (c) Supplies a proper breakdown and accounting on force account work

the sums withheld while either or all of the events existed will be converted to an additional lump sum and held by the owner until final completion, and no further retainage will be withheld unless...

- (1) Event (a) recurs, or
- (2) Event (b) recurs, or
- (3) Event (c) recurs

in which event or events the owner shall reinstate the 10 per cent retainage on all subsequent periodical estimates. At the discretion of the owner, the retainage of each subcontractor may be released separately as he completes his work. An application for release of a subcontractor's retainage shall bear the certificates of the subcontractor, the contractor, and the architect that the subcontractor's work has been fully performed and that the sum for which payment is requested is due by the contractor to the subcontractor. Checks releasing a subcontractor's retainage shall be made payable to the contractor, the contractor's surety, and the subcontractor and shall be mailed to the contractor's surety. This article does not create any contractual relationship between the owner and the subcontractor or any duty of the owner to any subcontractor. All warranties shall run from the date of the final certificate of the architect unless otherwise expressly provided in the contract. Payments pursuant to this article shall in no way diminish, change, alter or affect the rights of the owner under the contract documents.

5. FINAL PAYMENT. - (a) - Final payment shall be due \_\_\_\_\_ days after execution of the final certificate by the architect, provided that all other requirements of the contract shall have been met in full. Final payment shall be made by a check payable jointly to the contractor and surety and shall be mailed to the surety.

(b) - Upon receipt of written notice from the contractor pursuant to Article E-41 of the general conditions that the work is ready for final inspection, the architect shall promptly make such inspection, and when he finds the work complies with the contract and when the contract shall have been fully performed he shall promptly issue a final certificate, over his own signature, stating that the work provided for in this contract has been completed under the terms and conditions thereof, and that the entire balance found to be due the contractor and noted in final certificate, is due and payable.

(Form No. 418) (10-31-74)

(c) - Before issuance of final certificate, the contractor shall submit evidence satisfactory to the architect that all payrolls, material bills, and other indebtedness connected with the work have been paid.

(d) - If full completion of the work is materially delayed through no fault of the contractor, and the architect so certifies, the owner shall, upon certificate of the architect, and without terminating the contract, make payment of the balance due for that portion of the work fully completed. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

6. THE CONTRACT DOCUMENTS. - The general conditions of the contract, the specifications, the drawings, the signed proposal form, and the notice of acceptance of the said proposal together with this agreement form the contract, and they are as fully a part of the contract as if hereto attached or herein repeated. The drawings and specifications shall be identified by the architect pursuant to the general conditions.

7. BONDS. - The contractor shall furnish both a performance bond and a payment bond and shall pay premium thereon. The performance bond shall guarantee the full performance of the contract.

IN WITNESS WHEREOF the parties hereto have expected this agreement the day and year first written above.

Contracting Firm: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Notary: \_\_\_\_\_

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COUNTY BOARD OF EDUCATION OF RICHMOND COUNTY

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Notary: \_\_\_\_\_

(Form No. 418)  
(10-31-74)

SECTION F

SPECIAL CONDITIONS

F-01 Co-Ordination of Construction:

A - Pre-Construction Conference

Before any work is started, the Contractor, major subcontractors and superintendent for construction shall meet with the Architect/Owner's Representative to coordinate all new construction and to allow minimum disruption of existing facilities.

**B – Construction Progress Meetings (OAC Meetings)**

**Construction project meetings will be formally held a minimum of twice per month. The CONTRACTOR is responsible for preparing meeting agenda, schedules and logs needed for review and conducting the meeting. Meetings will be documented with meeting minutes issued by the Contractor within 3 days of the meeting. Format of the meeting and agenda requirements will be established by the Program Manager. As required in Section E, schedule updates and submittal logs will be provided at these meetings.**

C - Security

New construction shall be left secure at the end of each day. The Contractor is responsible for any damages, loss of items, etc. due to this deficiency

D - Material Storage

- (1) Any exterior on-site storage required by the Contractor shall be inside the temporary fenced area.
- (2) Exterior storage facilities shall be furnished by the Contractor and erected inside the temporary fenced area.
- (3) The Contractor shall provide, maintain and remove where directed suitable, substantial, water tight, secure storage for protection of material used in this work. Damaged, defective or unsuitable wet or damp materials shall be removed promptly from the site. Polyethylene covers are not acceptable. All roofing materials are stored under ventilated tarpaulins completely covered and raised off the ground.

F-02 SMOKING: The Contractor shall post notice and prohibit employees from using or displaying tobacco products, including smokeless tobacco, while the employee is on duty at the assigned location, for the duration of the project. There shall be no use of any tobacco product on any property of the Richmond County Board of Education.

F-03 TRASH DISPOSAL: The Contractor shall allow no trash to accumulate outside the buildings or work area. Area shall be cleaned at the close of each working day. Trash shall be disposed of off the school site. Burning of the material on the site will not be permitted.

F-04 FENCING:

The Contractor shall maintain and erect construction fencing and gates around the new construction area to provide protection of the public and Owner during the execution of the Contract.

- (1) Construction fence with metal tee studded steel posts with clamps. Install 6'-0" non-climbable heavy gauge wire fencing. Posts shall be spaced 10'-0" o.c. or less (4"x4" wood posts may be used in lieu thereof).
- (2) Provide gates at such locations as necessary, cross-braced and hung on heavy strap hinges, and provide hasps and padlocks.
- (3) This fence shall be erected before any work is started and in accordance with schedule approved by the Owner and Architect. On completion of the work or when directed by the Architect/Program Manager, the fences shall be removed by the Contractor and shall become his property and be removed from the site.

F-05 SANITATION:

The Contractor shall provide from the beginning of work washing facilities and temporary enclosed toilets for use of workmen on job. Such facilities shall be maintained in a clean and sanitary condition meeting all health standards throughout their use. The Contractor shall not permit any sanitary nuisance in or about the work area. Toilet facilities shall be located outside of the building work area.

F-06 PERMITS:

A - All permits, licenses, fees, electrical, sewer or water tap costs, etc., required for construction to be obtained and paid for by the Contractor.

F-07 OSHA

A - Every safety precaution will be taken during all stages of construction. All OSHA Safety requirements will be adhered to.

F-08 SAFEGUARDS:

- A - Contractor will be held liable for all damages to personal and real property as a result of his negligence to provide protective measures.
- B - When the need for protection installed no longer exists, the Contractor shall remove such protection devices.

F-09 TEMPORARY HEAT & AIR CONDITIONING:

A - The Contractor shall provide as his own expense temporary heat to protect all work and materials against injury from dampness and cold and to dry out building. Maintain building at a minimum of 60° during working hours, after building is "dried-in" ..

F-10 CUT-IN AND METERS:

A - Contractor is to apply for, pay for and install all utility cut-in and meters.



F-11 PROTECTION:

- A - Preserve in operating condition all active utilities traversing the project site; protect manholes, catch basins, valve boxes and other appurtenances. Repair damage to any such utility, due to work, under this contract, to the satisfaction of the Architect. Care must be taken to protect and preserve all trees within the site that do not fall within the building area itself.

F-12 MATERIALS AND PRODUCTS CONTAINING ASBESTOS

- A - The use of asbestos in any product incorporated within these specifications by any Contractor, Subcontractor, Manufacturer or material supplier is prohibited.

It is the intention of the Architect not to specify, approve or use any material that contains asbestos in any form. If materials included in these specifications contain asbestos, it shall be interpreted to be unknown to Architect. The Contractor, subcontractors, material suppliers and manufacturers shall notify Owner and Architect of materials containing asbestos and shall not supply or incorporate such materials in this project. If installed by the Contractor, it will be removed at the Contractor's expense.

F-13 JOB SITE SAFETY:

- A - Job site safety shall be the sole responsibility of the Contractor.

F-14 "ALL RISK" BUILDERS RISK INSURANCE:

- A - General Contractor shall purchase and maintain during the full course of construction "All-Risk" Builders Risk Insurance Coverage which names the Contractor, Owner, the Architect, and Engineers as co-insured.

F-15 SHOP DRAWINGS:

- A - Contractor shop drawings shall be reviewed only for general conformance with the intent of design for and for general compliance with the construction contract.

F-16 CONTRACT DOCUMENTS:

- A - The Contractor is responsible for examining all contract documents to determine if all drawing sheets and specification sheets contained in the sets agree with their respective indexes. The Architect will be notified prior to Bidding of any sets not complete. Any incomplete sets will be replaced.

- F-17 Construction documents shall be issued to the contractor in a reasonable number in which it will take to construct the project. Any drawings above that number shall be issued at the contractor's expense. The contractor is allotted the following:

<u>Cost of project</u>	<u>sets of drawings/specs</u>
\$ 50,000.00 or less	8
\$ 100,000.00 or less	10
\$ 250,000.00 or less	12
\$ Above \$250,000.00	15

F-18 SANITARY ARRANGEMENTS: The contractor shall post notice and take such precautions to keep the premises and all portions of the building clean and sanitary at all times. Temporary enclosed toilets are to be erected. These toilets are to be maintained in a sanitary condition by the General Contractor, and comply with State and Health Department requirements. The toilets of the Board of Education are not to be used by the contractor. The contractor is responsible to make sure that all employee (subs) use these temporary toilets.

F-19 STORAGE AND CARE OF MATERIALS: The contractor shall provide, maintain and remove when directed watertight storage for protection of materials used in this work. Damaged or defective materials shall be removed from the site.

F-20 CONTRACTOR'S FIELD OFFICE: At the beginning of construction, the contractor shall maintain an enclosed field office, complete with all pertinent plans, specifications, and shop drawings. A temporary telephone shall be installed for the duration of construction. Space for review of drawings by Architect and Owner shall be provided.

F-21 SHOP DRAWINGS AND SAMPLES:

(A) Shop Drawings

- (1) General Contractor shall check, approve and submit all shop drawings to Architect on sepia paper with positive side up or on original tracings. Sepias shall be a good quality, legible - do not fold.
- (2) Copies Required:
  - a. 1 Sepia or original (Contractor checked and approved).
  - b. 2 prints of Contractor checked and approved drawings.
- (3) Reproducible prints (sepias) will be returned to the General Contractor with Architect's Review including information as to changes required marked thereon. Architect will retain print and make such additional copies as he may require for his own information and file.
- (4) Where appreciable changes are required, Architect may require that drawings be revised, corrected, and resubmitted in accordance with subparagraph, (1) and (2) above.
- (5) Shop drawings shall comply with Architect's Review prior to manufacturing or fabricating any item or items in the project requiring shop drawings.

(B) Samples

- (1) Samples required under various Divisions of work shall be delivered to and stored at the job site until checked and approved, or disapproved. Resubmit samples as required.
- (2) RELEASE OF SAMPLES - When samples have served the purpose for which submitted, Contractor shall notify respective suppliers who may arrange for removal of samples. If, within, two weeks of notice, samples have not been removed, Contractor may dispose of them at his discretion.

(C) Manufacturer's Literature - Submit number of copies as required under various divisions of work.

F-22 BATTERBOARDS, LINES AND LEVELS: The contractor shall lay out the lines of the building, checking them with the lot lines. He shall mark the lines of the building on solidly constructed batter boards. The contractor shall maintain these batter boards and shall direct his engineer to run and test all lines and levels from time to time. The contractor shall be held responsible for the accuracy of the whole work throughout its progress.

F-23 SHOP DRAWINGS AND SUBMITTALS: Shop drawings and submittals are requested and checked by Architect to assist Contractor in confirming compliance with contract documents and shall be accepted by Architect subject to the following conditions:

- A. Contractor shall check drawings, mark corrections and stamp drawings. Shop drawings and submittals shall not be accepted unless so indicated.
- B. Changes from contract documents shall be clearly indicated on drawings and accompanied with letter indicating reasons for change
- C. Under no circumstances shall contract requirements be changed by shop drawings unless specifically approved by Architect and Owner. Failure of Architect to detect such a change does not justify changing contract requirements even if drawings are marked "Approved" or "No Exceptions" or "Note Markings".
- D. Material and equipment ordered, fabricated and delivered under conditions described in Paragraph "C" above shall be removed, replaced and corrected by Contractor at no additional cost to Owner.
- E. Drawings and submittals poorly prepared and requiring numerous corrections shall be returned without complete check and corrections marked for resubmittal.
- F. Submittals shall be complete. If shop drawings, samples and submittal data are required all shall be submitted to Architect at the same time. Parts of an incomplete submittal shall not be accepted and shall be returned to Contractor until complete submittal is received.
- G. Architect's drawings shall not be duplicated or copied for use as shop drawings.

## F-24 FINAL INSPECTION PROCEDURE

After all work is complete and Contractor submits request to Architect, including list of incomplete work which is beyond control of Contractor, Architect shall commence final inspection procedure.

- A. Purpose - Final inspection is not intended to provide Contractor with list of incomplete work which he uses to complete project, but is for the purpose of final acceptance, final payment and occupancy by Using Agency
- B. Preliminary Final Inspection - Conducted by Architect/Program Manager, Engineers and Contractor to confirm that all work is complete and to prepare list of items which must be corrected prior to final inspection.
- C. Final Inspection - Conducted by Architect/Program Manager (Owner's Representative), Engineers, and Contractor to confirm that all work is complete.
- D. Final Inspection Follow-Up - Conducted by Architect/Program Manager, Engineers, and Contractor to confirm that defective and incomplete items listed during final inspection have been completed, and to determine that final payment, including retainage, is due.
- E. False Starts - Architect/Program Manager is not obligated to conduct numerous inspections in order to assist Contractor to complete project. Any inspections required due to incomplete work, other than three listed above, shall be deemed as false starts or to have been requested prematurely, and next inspection shall not be conducted until Architect and Engineers have been reimbursed by Contractor for wasted time due to previous false start.
- F. Determination That Project Is Ready For Final Inspection - Architect and Engineers shall be responsible for determining that their respective phases of work are complete and that portion or project is ready for final inspection. If, after commencing an inspection, project is determined not to be ready for inspection, that shall constitute a false start.

F-25 REMOVAL OF WASTE FROM SITE:

Contractor shall have a solid waste handling permit by rule issued by the Georgia Environmental Protection Division complying with Section 391-3-4-.06(3)(a) of the Rules for Solid Waste Management:

1. **Vehicle Construction:** Vehicles or containers used for collection and transportation of garbage and similar putrescible wastes, or mixtures containing such wastes, shall be covered, substantially leakproof, durable, and of easily cleanable construction.
2. **Vehicle Maintenance:** Solid waste collection and transportation vehicles shall be cleaned frequently and shall be maintained in good repair.
3. **Littering and Spillage:** Vehicles or containers used for the collection and transportation of solid waste shall be loaded and moved in such a manner that the contents will not fall, leak or spill therefrom and shall be covered when necessary to prevent blowing of material from the vehicle.
4. **No regulated quantities of hazardous wastes may be collected and transported except in accordance with the provisions of the Georgia Hazardous Waste Management Act, O.C.G.A. 12-8-60 et seq.**
5. **Local Ordinances:** It is the responsibility of the collector to comply with all local rules, regulations, and ordinances pertaining to operation of solid waste collection systems.
6. **All wastewater from cleaning of vehicles must be handled in manner which meets all applicable environmental laws and regulations.**
7. **All collected solid waste must be deposited only in a permitted solid waste handling facility authorized to receive the applicable waste types.**
8. **After July 1, 1992, municipal solid waste may not be transported from a jurisdiction to a municipal solid waste disposal facility located in another county unless the jurisdiction generating the waste is actively involved in and has a strategy for meeting the State-wide goal of waste reduction by July 1, 1996.**

The contractor shall disclose the landfill in which they will be using in subject project.

The contractor shall provide to the Richmond County Board of Education solid waste tipping fee receipts from the landfill.

## Definitions

“Collector” means the person or persons as defined herein who, under agreements, verbal or written, with or without compensation does the work of collecting and/or transporting solid wastes, from industries, offices, retail outlets, businesses, institutions, and/or similar locations, or from residential dwellings, provided however, that this definition shall not include an individual collecting and/or transporting waste from his own single family dwelling unit.

“Construction/Demolition Waste” means waste building materials and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings and other structures. Such wastes include, but are not limited to asbestos containing waste, wood, bricks, metals, concrete, wall board, paper, cardboard, inert waste landfill material, and other nonputrescible wastes which have a low potential for groundwater contamination.

## Section G

### Project Close-Out Requirements and Procedures

#### Article G-01. General Provisions

The following *Project Close-Out Requirements and Procedures, Articles G-01 to G-11*, inclusive, bound herein and hereafter referred to as the “Project Close-Out Requirements and Procedures” provide the requirements and procedures for the close-out of the project and are binding to the contract. There are references to these and other requirements and procedures in other sections of the specifications. Requirements and procedures in other sections that are in addition to those in this section are also binding to the contract. Where conflicts arise between the requirements of this section and other sections of the specifications, the more stringent requirement will govern.

**Contractor will provide two hard copies of all closeout documents in the section and one electronic copy on a flash drive. All documents will be organized and clearly labeled.**

#### Article G-02. Close-Out Requirement Retainages for Final Payment

- (a) The completion of the Close-Out Requirements and Procedures is critical to the Owner’s ability to manage, operate and maintain the facility and is therefore a valuable part of the project. To help ensure the proper completion of the Close-Out requirements and procedures, the following values are established for each of the components of the Close-Out requirements. The value for each component will be held as retainage until ALL requirements of that component are submitted, reviewed and approved. NO partial release of the retainage for a component will be made; the retainage for a component will only be released when that component is 100% complete and approved.
- (b) The following are the retainage values for each component of the Close-Out requirement. Items (a), (b) and (c) are required to be completed and turned over to the Owner prior to or at the time of substantial completion. If a component (d) through (h) is incomplete after 120 days, the Contractor will forfeit the retainage for the component to the Owner as compensation for the efforts that will be required by the Owner to obtain/complete the items in the component.

		Contracts < \$2 Million	Contracts \$2 - \$5 Million	Contracts > \$5 Million
(a)	Initial Owner Hand-Off Session	\$2,000	\$5,000	\$5,000
(b)	Close-Out Documents	\$5,000	\$5,000	\$10,000
(c)	Training	\$5,000	\$5,000	\$5,000
(d)	Certifications & Warranties	\$5,000	\$5,000	\$10,000
(e)	Spare Part, Tools & Attic Stock	\$2,000	\$5,000	\$5,000
(f)	As-Builts, Drawings & Reports	\$3,000	\$5,000	\$10,000
(g)	O&M Manuals	\$2,000	\$3,000	\$5,000
(h)	Finishes Listing	\$2,000	\$2,000	\$2,000

Note: Various Close-Out Documents must be submitted and approved by the Architect and Owner before **ANY** retainage is released, so the retainage holdings above apply only after the required documents to reduce the overall project contingency have been submitted and approved. See the following articles and General Conditions for requirements for reduction of retainage.

**Article G-03. Initial Owner Hand-Off Session**

- (a) At the direction of the Architect and Program Manager, in coordination with the Owner, the Contractor will conduct an Initial Owner Hand-Off Session for the project **at the time of substantial completion and prior to the time when the Owner takes occupancy of the building**. In order to prepare for the transition from Contractor control of the construction site to the Owner control of the new facility, an Initial Owner Hand-Off Session will be conducted. This session is NOT intended to be the training session for the individual systems and equipment required by the contract. This session is intended to be an opportunity to familiarize the District staff with the facility and provide them with the necessary documentation and orientation of the systems in the building(s) so District staff may properly and effectively manage the facility once it is turned over.
- (b) Issues to be covered at the Owner Hand-Off Session:
- a. Draft O&M Manuals: The Contractor will provide draft manual of all mechanical, electrical and motorized equipment for the Owner's use until the final O&M Manuals have been submitted, reviewed and approved by the Architect.
  - b. Keys and Access Codes: The Contractor will provide an inventory of which keys and codes have been provided and which are outstanding, as well as a schedule for providing the remaining keys and codes.
  - c. Training Status : The participating parties will review the training status for required Owner training, including an inventory of which trainings have been conducted and which are outstanding, as well as a schedule for conducting the remaining training.
  - d. Subcontractor Walkthrough: The subcontractors will walk the maintenance staff through the building and provide an orientation on all systems installed by subcontractor as well as review basic safety, operation and monitoring processes. If the formal Owner training has been conducted prior to this session, the orientation for those systems will not be necessary. If the formal training has not been completed, this orientation will provide the Owner's staff with the basic information to allow them to occupy and "operate" the systems until the formal training is completed.
  - e. Interim Set of Project Plans: The Contractor (with the assistance of the Architect) will provide the Owner with an interim set of project plans and specifications for use on-site until the final as-built plans have been submitted, reviewed and approved by the Architect.
  - f. Maintenance Responsibility Turnover: The Contractor will provide a **written notification** to the Owner regarding which items/areas the Contractor is turning over for the Owner to assume responsibility for maintenance and operations. This procedure eliminates



confusion regarding which party is responsible for maintenance and operation of certain systems, equipment, grounds and the like.

(c) Required Participation in the Owner Hand-Off Session:

- a. Required Contractor/Subcontractor Personnel to be present at a minimum:
  - i. General Contractor Project Manager and Superintendent
  - ii. HVAC Subcontractor Superintendent
  - iii. Electrical Subcontractor Superintendent
  - iv. Plumbing Subcontractor Superintendent
  - v. Other Subcontractors as requested by the Owner, Architect or Program Manager
- b. Owner Representatives who may be present:
  - i. Director of Maintenance and Custodial Services, or his designated representative
  - ii. School/Facility Custodial Staff
  - iii. Maintenance Department HVAC Supervisor
  - iv. Maintenance Department Electrical Supervisor
  - v. Maintenance Department Plumbing Supervisor
  - vi. Assistant Director of Construction and Renovation
- c. Project Architect and Engineers
- d. Program Manager

(d) Initial Owner Hand-Off Session Checklist

- a. The results of the Initial Owner Hand-Off Session will be documented on the Initial Owner Hand-Off Session Checklist included herein.
- b. A copy of the completed Checklist will be submitted to the Owner (through the Architect) as a component of the project close-out process in order to provide a record of the items covered as well as a roster of the individuals who participated in the Initial Owner Hand-Off Session.

### Initial Owner Hand-Off Session Checklist

School/Facility:

Date:

	Draft O&M Manuals	Keys	Access Codes	Training Status	Walkthrough with Subcontractor
HVAC - Mechanical Equipment					
HVAC Controls					
Lighting Controls					
Fire Alarm					
Intercom					
Security/Intrusion System					
Video Surveillance					
Video Distribution System					
Data/Voice System					
Athletic Equipment (bleachers, goals, etc)					
Elevators					
Building Keys	Required to be sent directly to Maintenance Department				
Landscape and Field Irrigation Sys.					
Other:					
Other:					
Other:					

Interim Set of Plans and Copy of Specifications

Maintenance Responsibility Turnover Notification (List/Letter)

Walk through with Maintenance Staff and Key subcontractors

In order to prepare for the transition from Contractor control of the construction site to the Owner control of the new facility, an Initial Owner Hand-Off Session will be conducted. This session is NOT intended to be the training session for the individual systems and equipment required by the contract. This session is intended to be an opportunity to familiarize the District staff with the facility and provide them with the necessary documentation and orientation of the systems in the building(s) so District staff may properly and effectively manage the facility once it is turned over.

**Initial Owner Hand-Off Session Attendance Roster**

School/Facility:

Date:

<b>Contractor and Subcontractors:</b>	
<b>Name</b>	<b>Company</b>

<b>District and School Staff</b>	
<b>Name</b>	<b>Department</b>

<b>Architect and Engineers</b>	
<b>Name</b>	<b>Company</b>

<b>Program Manager</b>	
<b>Name</b>	<b>Company</b>

**Article G-04. Early Certifications and Document Requirements**

- (a) The Contractor will provide copies of the Early Certifications and Documents from Permitting Agencies and Governmental Agencies which are required for occupancy of the facility. **The complete submittal must be made at the time of project turn over and Owner occupancy, or earlier if certifications and inspections are completed well ahead of Owner occupancy. The Early Certifications and Documents will be submitted in a complete package to the Owner through the Architect.**
- (b) The following Certifications, Documents and Items are Required:
- a. Certificate of Occupancy
  - b. Fire Alarm System Certification
  - c. Fire Sprinkler System Certification
  - d. Augusta/Richmond County Building Inspector Letter of Completion
  - e. Augusta/Richmond County Fire Department Life Fire Safety Report
  - f. Department of Labor Boiler Certificates
  - g. Department of Labor Elevator Certificates
  - h. Certificate of Water System Disinfection
  - i. Permanent Keys

**Article G-05. Close-Out Documents**

- (a) The General Conditions and Contract require specific contractual documents to be provided by the Contractor at Close-Out in order to complete the obligations of the Contractor and to provide required contractual protections for final payment. The Close-Out Documents shall be submitted as a complete package to the Owner through the Architect.
- (b) The following are the minimum contract Close-Out Documents required for final payment. Additional documents may be required by the General Conditions, Contract or other specifications provided in the Bid and Contract Documents. **Items "a" through "e" MUST be submitted before ANY project retainage can be released.**
- a. ***AIA G707 – Consent of Surety Company for Final Payment***
  - b. ***AIA G706 – Contractor's Affidavit of Debts and Claims***
  - c. ***AIA G706A – Contractor's Affidavit and Release of Liens from***
    - i. ***General Contractor***
    - ii. ***Sitework Subcontractor***
    - iii. ***Mechanical Subcontractor***
    - iv. ***Plumbing Subcontractor***
    - v. ***Electrical Subcontractor***
    - vi. ***Other Major Subcontractors***
    - vii. ***Major Material Suppliers/Vendors***
  - d. ***Statutory Affidavit***
  - e. ***Non-Influence Affidavit***
  - f. Certificate of Substantial Completion
  - g. Contractor's Written Guarantee on Company Letterhead
  - h. Contractor's Cleanup Letter on Company Letterhead
  - i. Contractor's Asbestos Letter on Company Letterhead (No Asbestos Used)

- j. List of Subcontractors/Suppliers/Vendors (Must include services/materials provided, company name, address, phone numbers, contact person's name and e-mail address)
- k. Low Voltage Systems Certifications (for systems other than Fire Alarm Systems Certification, which is required as part of Early Certifications and Documents)

**Article G-06. Training Requirements**

- (a) The Contractor will provide training for all equipment and systems installed by the Contractor. The Contractor shall be responsible for scheduling all training with the Owner, in coordination with the Architect, through the Owner's designated representative and at a time convenient to the Owner's staff.
- (b) Training Requirements:
  - (a) Two levels of training are required for systems and equipment.
    - i. The first level of training is for the District Maintenance Staff. The Contractor MUST provide training to CERTIFY the District Maintenance Staff to the level of being "FACTORY CERTIFIED" to operate, maintain, service and repair any equipment, system or device that requires certified personnel to operate, maintain or repair these items in order to maintain warranties and operate the system/equipment in compliance with codes and regulations. The Owner must be able to operate, maintain and repair ALL equipment, systems and devices installed in the facility WITHOUT the assistance of the Contractor, manufacturer or other outside entity.
    - ii. The second level of training is for the Facility Staff. This will be the user level training on the operation of the equipment/systems and will be performed separately from the District Maintenance Staff training. This training will be conducted on-site and will be preformed by the Manufacturer's certified and authorized training personnel. Applicable subcontractor/vendor personnel will be present at the training session along with the Contractor's superintendent. The District Maintenance Staff will also attend this training session to observe the training being conducted.
  - (b) The Contractor will provide at the time of training all special tools, cables, equipment, software, laptops and the like that may be required for the monitoring, operation, maintenance and repair of the systems, equipment and devices.
  - (c) The Contractor will generate an attendance roster of the training session showing the date, time, location and names, company and phone numbers of everyone attending the training session including the Contractor/Subcontractor/Vendor and the Owner's staff.

- (d) The Contractor will submit a Close-Out Package for Training to the Owner to document the training conducted with the following documents:
- i. Letter on Company Letterhead indicating that ALL required training has been completed;
  - ii. List of all training sessions held both on-site and off-site;
  - iii. List of all tools, cables, equipment, software, laptops or other devices that were provided to Owner during training; and
  - iv. Copies of attendance rosters for all training sessions.
- (e) Unless designated otherwise, the Contractor will be expected to provide the CERTIFIED level of training for the District Maintenance Staff for the following systems/equipment:
- i. ALL HVAC Equipment
  - ii. HVAC Controls System
  - iii. Fire Alarm System
  - iv. Intercom System
  - v. Video Distribution System
  - vi. Data and Voice Systems
  - vii. Security Systems
  - viii. Video Surveillance Systems
  - ix. Generators
  - x. Kitchen Equipment
- (f) On-site user level training will be required at a minimum for the following systems. Other training may be required for systems not listed that require operation and/or maintenance activities from the Owner for the routine operation of the facility.
- i. ALL HVAC Equipment
  - ii. HVAC Controls System
  - iii. Boilers
  - iv. Booster Pumps
  - v. Water Treatment Systems
  - vi. Fire Alarm System
  - vii. Intercom System
  - viii. Video Distribution System
  - ix. Data and Voice Systems
  - x. Security Systems
  - xi. Video Surveillance Systems
  - xii. Generators
  - xiii. Kitchen Equipment
  - xiv. Carpet Maintenance
  - xv. Science Casework

**Article G-07. Certifications, Warranties and Bonds**

- (a) Certifications, Warranties and Bonds will be provided in a separate Close-Out Package. This is to be provided in a 3-ring binder with all documents in clear protective covers. A directory with a listing of all documents will be provided at the front of the book. The Directory will include a list of products, manufacturers, length of warranty and contact information for each manufacturer for extended warranties after Contractor's warranty/guarantee has expired to include address, phone number and e-mail address. The Certifications, Warranties and Bonds Close-Out Package will be submitted in one complete package to the Owner through the Architect.
- (b) The items listed in Item (c) below are required to be included in the Certifications, Warranties and Bonds Close-Out Package. Other Certifications, Warranties and Bonds that are required by the Architect or Engineer in the technical specifications, but not listed here, MUST also be included in the Close-Out Package.
- (c) Required Certifications, Warranties and Bonds
  - a. Asbestos Abatement Certification
  - b. Asbestos Tipping Receipts
  - c. Notice of Termination (N.O.T.) for Erosion Control
  - d. Contractor Certification that final grades are per plans
  - e. Roof Warranty – 20 Year Minimum
  - f. Mechanical Diagnostic Code Data and Troubleshooting
  - g. Mechanical Equipment – 5 year compressor warranty
  - h. Cooling Tower Performance Certification
  - i. Lightning Protection Certification
  - j. Generator – 5 year warranty
  - k. Termite Treatment Bond
  - l. Termite Treatment Maintenance Proposal/Agreement
  - m. Intrusion Detection System – 2 Year Maintenance Agreement
  - n. Video Surveillance System– 3 Year Service Warranty
  - o. Carpet Installation – 1 Year Guarantee
  - p. Carpet Material – 3 Year Guarantee / 15 Year Warranty
  - q. MSDS Sheets on mastic for carpet & tile
  - r. Toilet Partitions – 10 Year Warranty
  - s. Science Casework – 1 Year Guarantee
  - t. Media Casework – 1 Year Guarantee
  - u. Casework – 3 Year Guarantee/ 10 Year Warranty
  - v. Irrigation System Warranty
  - w. Certificates from Manufacturers of Major Components (see Article E67 of the General Conditions)
    - i. Major Components of AC Systems: cooling towers, compressors, condensers, absorption units, chillers, fan coils air handlers, boilers, pumps and temperature controls
    - ii. Major Components of Heating Systems: boilers, pumps, air handlers, unit ventilators, fan coils, temperature controls and chemical feed systems
    - iii. Major Components of Plumbing Systems: boilers, pumps, sewage pumps and water treatment systems
    - iv. Elevators, Lifts, Escalators
    - v. Incinerator Systems

**Article G-08. Spare Parts, Tools and Attic Stock**

- (a) As part of the project requirements the Contractor will be required to turn over spare parts, tools and attic stock to the Owner at project turnover. These items are to be turned over to the Director of Operations (or his designee) ( RCSS Maintenance and Facilities, 2956 Mike Padgett Hwy, Augusta, GA 30906
  
- (b) The Contractor will be required to coordinate the turnover of ALL the parts, tools and attic stock with the Director of Operations, Maintenance and Facilities or his designated representative. At the time of turnover, the Contractor will provide a DETAILED list of ALL items being turned over to include list of each part and item, colors, sizes, quantities or other pertinent information. The Contractor MUST obtain the signature on a Letter of Transmittal, by the Director of Operations, RCSS Maintenance and Facilities, or his designee, though the Architect..
  
- (c) The Contractor will submit to the Owner a Close-Out Package for Spare Parts, Tools and Attic Stock in order to document the items turned over. This submittal will include a listing of all items turned over, as well as the signature of the Owner's staff person acknowledging receipt of the items. This submittal will be made to the Owner through the Architect.
  
- (d) The following items are required by the Owner as minimum items to be turned over. Other items as specified by the Architect and Engineer in their specifications will also be turned over with the same process and must be documented in the same manner as part of the turn over submittal. In cases where the Owner and Architect/Engineer require items of the same specification section, the Contractor will provide the quantity which is the GREATER of the two requirements.
  - a. VCT/SVT - 1% of the field tile and 1 box of each accent color
  - b. Ceiling Tile – 1% (minimum of 2 boxes) for standard tile, 1 box of other types
  - c. Paint – 1 gallon new and unopened of EACH color, and type of paint. Clearly labeled
  - d. Carpet Tiles – 1% of each color
  - e. Irrigation systems – 10% of each type of head when 10 or more are installed
  - f. HVAC Filters – 1 complete set for ALL units, IN ADDITION to filter installed at turnover.
  - g. HVAC Controls – 10% of Boards when 10 or more are installed
  - h. HVAC Controls – Laptop for operation of control system (Compliant with current RCSS IT standards for administrative users
  - i. Fire Sprinkler system – spare heads and tools as required by code.
  - j. Spare Parts, Tools and Attic Stock per the requirements of the Architect and Engineer specifications and drawings

**Article G-09. As-Builts, Required Drawings and Reports**

- (a) The General Conditions and Contract require specific As-Builts, Drawings and Reports to be provided by the Contractor at Close-Out in order to complete the obligations of the Contractor. As-Builts, Required Drawings and Reports will be submitted to the Owner through the Architect.



- (b) All drawings will be provided in hard copy format and in electronic format (PDF).
- (c) The following are the minimum As-Builts, Drawings and Reports required for final payment. Additional documents may be required by the General Conditions, Contract or other specifications provided in the Bid and Contract Documents.
  - a. Registered Land Survey of Site Utilities. **Provide GPS locations** for the following: all exterior valves, switches, and disconnects, boxes, manholes, connections or other key components of the site utility systems; empty 4" PVC sleeves under all new roads and sidewalks for future electrical or mechanical systems; empty conduits for electrical, cable, computer, sewer and water for future portable classrooms, future ball fields or structures (with concrete markers at stub out locations).
  - b. Registered Land Survey of Site Improvements
  - c. **Contractor As-Builts** of Contract Drawings
  - d. Fire Sprinkler System
  - e. Fire Alarm System
  - f. Landscaping and Ball field Irrigation System As-Builts
  - g. HVAC Test and Balance Reports
  - h. Other items required by the Architect and Engineer in the technical specifications and drawings
- (d) The PROJECT ARCHITECT will provide the following documents to the Owner at the completion of the project. These are NOT the responsibility of the Contractor to obtain and submit.
  - a. Architect to provide AutoCAD of Floor Plan w/square footages for each space
  - b. Architect to provide DWG/DXF of ALL Drawings, Specifications and Changes to the design documents.

**Article G-10. O&M Manuals**

- (a) For all items of mechanical or electrical equipment or apparatus installed which require operation or maintenance after occupancy, the Contractor shall furnish and deliver to the Owner (through the Architect) complete brochures and data as prepared and published by the manufacturers covering details regarding operation and maintenance.
- (b) Requirements for Operation and Maintenance Manuals can be found in Article E-55 of the General Conditions.
- (c) The Contractor will refer to the Architect and Engineer Technical Specifications to determine specifically what equipment and materials require the submission of Operation and Maintenance Manuals.

**Article G-11. Finishes Listing**

- (a) The Contractor will provide a listing of all materials installed on the project which are exposed to view. This listing will include the material name, manufacturer, model number, style number, color name or number, and any other information necessary to enable the Owner to order replacement

parts/materials which match those installed on the project. This listing will be submitted to the Owner through the Architect.

(b) The following items at a minimum must be listed on the Finishes Listing, if installed on the project:

a. Exterior

- i. Brick
- ii. Precast
- iii. Mortar
- iv. Metal trim
- v. Windows
- vi. Glass tinting
- vii. Caulk
- viii. Storefront
- ix. Paint
- x. Fascia and Soffits
- xi. Gutters and Downspouts
- xii. Metal roof
- xiii. Shingles
- xiv. Flashings and Coping
- xv. Canopies

b. Interior

- i. Paint
- ii. Caulk
- iii. Carpets
- iv. VCT
- v. Vinyl base
- vi. Stair treads, transitions, and similar equipment
- vii. Ceramic tile
- viii. Terrazzo
- ix. Colored concrete
- x. Gym floor sealer
- xi. Gym floor striping paints
- xii. Gym floor base
- xiii. Gym wall pads
- xiv. Bleacher seats
- xv. Toilet partitions
- xvi. Wood doors
- xvii. Casework stains
- xviii. Plastic laminates
- xix. Solid surface tops
- xx. Acoustical ceiling grid
- xxi. Acoustical ceiling tile
- xxii. Acoustical panels
- xxiii. Curtains
- xxiv. Blinds
- xxv. Storefront

(c) Sample format for the Project Finishes Listing is included herein.

**Project Finishes Listing**

School/Facility: \_\_\_\_\_

Date:

<b>Exterior</b>	<b>Manufacturer Name</b>	<b>Model Number</b>	<b>Style Number</b>	<b>Color Number</b>	<b>Other</b>
Brick					
Precast stone					
Mortar					
Metal trim					
Window metal					
Glass tinting					
Caulk					
Storefront					
Paint					
Fascia & Soffits					
Gutters & Downspouts					
Metal roof					
Shingles					
Flashings and Coping					
Canopies					
Other:					
Other:					

<b>Interior</b>	<b>Manufacturer Name</b>	<b>Model Number</b>	<b>Style Number</b>	<b>Color Number</b>	<b>Other</b>
Paint					
Caulking					
Carpets					
VCT					
Vinyl base					
Stair treads, transitions, etc					
Ceramic tile					
Terrazzo					
Colored concrete					
Gym floor sealer					
Gym floor striping paints					
Gym floor base					
Gym wall pads					
Bleacher seats					
Toilet Partitions					
Wood doors					
Casework stain					
Plastic laminates					
Solid surface tops					
Acoustical ceiling grid					
Acoustical ceiling tiles					
Curtains					
Blinds					
Storefront					
Acoustical panels					
Other:					
Other:					
Other:					



## **SECTION 01210 - ALLOWANCES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements governing allowances.
  - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.
  - 2. Unit-cost allowances.
  - 3. Quantity allowances.
  - 4. Contingency allowances.

#### **1.3 SELECTION AND PURCHASE**

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

#### **1.4 ACTION SUBMITTALS**

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

## 1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

## 1.7 ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials **selected by Owner** under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
  - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

## 1.8 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

## 1.9 TESTING AND INSPECTING ALLOWANCES

- A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

## ALLOWANCES

- B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- C. Costs of services not required by the Contract Documents are not included in the allowance.
- D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

#### **1.10 ADJUSTMENT OF ALLOWANCES**

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
  - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
  - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
  - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
  - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
  - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.
  - 3. When allowed work is to be furnished and/or installed by contractors other than the General Contractor, a minimum of three proposals for each lump sum allowance must be obtained before approval of work is granted.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

**3.2 PREPARATION**

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

**3.3 SCHEDULE OF ALLOWANCES**

- A. Allowance No. 1: Contingency Allowance: Include a contingency allowance of \$50,000.00 for use according to Owner's written instructions.

**END OF SECTION**



## **SECTION 01230 - ALTERNATES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for alternates.

#### **1.3 DEFINITIONS**

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### **1.4 PROCEDURES**

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 SCHEDULE OF ALTERNATES**

- A. Alternate No. 1: Roof Membrane Thickness.
1. Base Bid: **Include .60** (60 mil) reinforced, fire retardant EPDM membrane with 20 year warranty.
  2. Alternate: Include .90 (90 mil) fire retardant EPDM membrane with NDL 30 year warranty.

**END OF SECTION**

**SECTION 01310  
PROJECT MANAGEMENT AND COORDINATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. Requests for Information (RFIs).
  - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

**1.3 DEFINITIONS**

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within **15** days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

## 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.

- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

## **1.6 COORDINATION DRAWINGS**

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

## **1.7 REQUESTS FOR INFORMATION (RFIs)**

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
  - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. Project number.
  - 3. Date.
  - 4. Name of Contractor.
  - 5. Name of Architect
  - 6. RFI number, numbered sequentially.
  - 7. RFI subject.
  - 8. Specification Section number and title and related paragraphs, as appropriate.
  - 9. Drawing number and detail references, as appropriate.
  - 10. Field dimensions and conditions, as appropriate.

11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Specifications
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-monthly.
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.

- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 5 days if Contractor disagrees with response.

## 1.8 PROJECT MEETINGS

- A. General: The contractor shall schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, and Architect, within three days of the meeting.
  
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after execution of the Agreement.
  - 1. Conduct the conference to review responsibilities and personnel assignments.
  - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communications.
    - f. Procedures for processing field decisions and Change Orders.
    - g. Procedures for RFIs.
    - h. Procedures for testing and inspecting.
    - i. Procedures for processing Applications for Payment.
    - j. Distribution of the Contract Documents.
    - k. Submittal procedures.
    - l. Preparation of Record documents.
    - m. Use of the premises and existing building.
    - n. Work restrictions.
    - o. Working hours.
    - p. Owner's occupancy requirements.
    - q. Responsibility for temporary facilities and controls.
    - r. Procedures for moisture and mold control.

- s. Procedures for disruptions and shutdowns.
  - t. Construction waste management and recycling.
  - u. Parking availability.
  - v. Office, work, and storage areas.
  - w. Equipment deliveries and priorities.
  - x. First aid.
  - y. Security.
  - z. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Possible conflicts.
    - i. Compatibility requirements.
    - j. Time schedules.
    - k. Weather limitations.
    - l. Manufacturer's written instructions.
    - m. Warranty requirements.
    - n. Compatibility of materials.
    - o. Acceptability of substrates.
    - p. Temporary facilities and controls.
    - q. Space and access limitations.
    - r. Regulations of authorities having jurisdiction.
    - s. Testing and inspecting requirements.
    - t. Installation procedures.
    - u. Coordination with other work.
    - v. Required performance results.
    - w. Protection of adjacent work.
    - x. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.



5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Progress cleaning.
    - 10) Quality and work standards.
    - 11) Status of correction of deficient items.
    - 12) Field observations.
    - 13) Status of RFIs.
    - 14) Status of proposal requests.
    - 15) Pending changes.
    - 16) Status of Change Orders.
    - 17) Pending claims and disputes.
    - 18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**

## **SECTION 01400 - QUALITY REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. Specific test and inspection requirements are not specified in this Section.

#### **1.3 DEFINITIONS**

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review

coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
  2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
  3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### **1.4 CONFLICTING REQUIREMENTS**

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting

requirements that are different, but apparently equal, to Architect for a decision before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data : For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - 4. Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.
  - 7. Time schedule or time span for tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.

## **1.6 REPORTS AND DOCUMENTS**

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## **1.7 QUALITY ASSURANCE**

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

## **1.8 QUALITY CONTROL**

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01330 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.



3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 REPAIR AND PROTECTION**

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01700 "Execution Requirements."
- B. Protect construction exposed by or for quality-control service activities.

- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION**

## **SECTION 01700 - EXECUTION REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 01770 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
  - 2. Section 01732 "Selective Demolition" for demolition and removal of selected portions of the building.

#### **1.3 DEFINITIONS**

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

#### **1.4 QUALITY ASSURANCE**

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include, but are not limited to the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Mechanical systems piping and ducts.
    - e. Control systems.
    - f. Communication systems.
    - g. Fire-detection and -alarm systems.
    - h. Electrical wiring systems.
    - i. Operating systems of special construction.
  3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. **Other construction elements include but are not limited to the following:**
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Sprayed fire-resistive material.
    - d. Equipment supports.
    - e. Piping, ductwork, vessels, and equipment.
    - f. Noise- and vibration-control elements and systems.
  4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## EXECUTION

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, **mechanical and electrical systems**, and other construction affecting the Work.
  - 1. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
  
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  - 1. Description of the Work.
  - 2. List of detrimental conditions, including substrates.
  - 3. List of unacceptable installation tolerances.
  - 4. Recommended corrections.
  
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
  
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
  
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions

outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01310 "Project Management and Coordination."

### **3.3 CONSTRUCTION LAYOUT**

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

### **3.4 INSTALLATION**

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor

## **EXECUTION**

bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01100 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to **prevent** interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### **3.6 OWNER-INSTALLED PRODUCTS**

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

## **EXECUTION**



1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### **3.7 PROGRESS CLEANING**

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section E.

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### **3.8 STARTING AND ADJUSTING**

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01400 "Quality Requirements."

### **3.9 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

**END OF SECTION**

## **SECTION 01732 - SELECTIVE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Salvage of existing items to be reused or recycled.

#### **1.3 DEFINITIONS**

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### **1.4 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

**1.5 QUALITY ASSURANCE**

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

**1.6 FIELD CONDITIONS**

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

**1.7 COORDINATION**

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

**PART 2 - PRODUCTS****2.1 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

**SELECTIVE DEMOLITION**

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

#### **3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS**

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

#### **3.3 PROTECTION**

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- B. Remove temporary barricades and protections where hazards no longer exist.

#### **3.4 SELECTIVE DEMOLITION, GENERAL**

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining

- construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain adequate ventilation when using cutting torches.
  6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  9. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### **3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS**

- A. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

- B. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07530 FULLY ADHERED EPDM ROOFING for new roofing requirements.
  - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
  - 2. Remove existing roofing system down to substrate.
  - 3. Notify Roofing Consultant and Architect when areas are revealed below insulation for inspection.

### **3.6 DISPOSAL OF DEMOLISHED MATERIALS**

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to specifications.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

### **3.7 CLEANING**

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION**





## **SECTION 01770 - CLOSEOUT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Closeout of the project work
  - 2. Preparation and turnover of documents to the OWNER
  - 3. Training of RCCS personnel on equipment provided.
- B. Related Requirements:
  - 1. Section E GENERAL CONDITIONS.
  - 2. Section F SPECIAL CONDITIONS.
  - 3. Section G Project Closeout Requirements and Procedures

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections.

### **PART 3 - EXECUTION**

- A. General: Comply with requirements specified in other Sections.

**END OF SECTION**



**SECTION 01781  
PROJECT RECORD DOCUMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section G "PROJECT CLOSEOUT REQUIREMENTS AND PROCEDURES " for general closeout procedures.
  - 2. Section G for " PROJECT CLOSEOUT REQUIREMENTS AND PROCEDURES " for operation and maintenance manual requirements.

**1.3 CLOSEOUT SUBMITTALS**

- A. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities.

**PART 2 - PRODUCTS**

**2.1 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
  - b. Accurately record information in an acceptable drawing technique.
  - c. Record data as soon as possible after obtaining it.
  - d. Record and check the markup before enclosing concealed installations.
  - e. Cross-reference record prints to corresponding archive photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
- a. Dimensional changes to Drawings.
  - b. Revisions to details shown on Drawings.
  - c. Depths of foundations below first floor.
  - d. Locations and depths of underground utilities.
  - e. Revisions to routing of piping and conduits.
  - f. Revisions to electrical circuitry.
  - g. Actual equipment locations.
  - h. Duct size and routing.
  - i. Locations of concealed internal utilities.
  - j. Changes made following Architect's written orders.
  - k. Details not on the original Contract Drawings.
  - l. Field records for variable and concealed conditions.
  - m. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

### **2.3 RECORD PRODUCT DATA**

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, record Specifications, and record Drawings where applicable.

### **2.4 MISCELLANEOUS RECORD SUBMITTALS**

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## **PART 3 - EXECUTION**

### **3.1 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Program Manager's reference during normal working hours.

**END OF SECTION**



## **SECTION 061000 - ROUGH CARPENTRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Wood nailers and curbs for roofing and items installed on roof.
- B. Roofing cant strips.
- C. Miscellaneous wood nailers, furring, and grounds.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 62 00 - Sheet Metal Flashing and Trim.
- B. Section 07530 – Adhered EPDM Roofing

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard; 1999.
- B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.
- D. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.
- E. PS 1 - Structural Plywood; latest edition.
- F. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); latest edition.
- G. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.

#### **1.04 QUALITY ASSURANCE**

- A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
  - 1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee ([www.alsc.org](http://www.alsc.org)) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

## **2.02 DIMENSION LUMBER**

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Blocking, Furring, and Nailers:

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

## **2.03 WOOD-PRESERVATIVE-TREATED MATERIALS**

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:

- a. Copper bis (dimethyldithiocarbamate) (CDDC).
- b. Ammoniacal copper citrate (CC).
- c. Copper azole, Type A (CBA-A).

2. Treatment at roof nailers shall be acceptable to roof manufacturer.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

## **2.04 ACCESSORIES**

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Anchors: Toggle bolt type for anchorage to hollow masonry.
3. Power-Driven Fasteners: CABO NER-272.
4. Lag Bolts: ASME B18.2.1.

## **ROUGH CARPENTRY**



## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Coordinate installation of rough carpentry members specified in other sections.

### **3.02 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- D. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

**END OF SECTION**



**SECTION 07015  
PREPARATION FOR REROOFING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Partial tear-off of entire roof.
  - 2. Removal of base flashings.
  - 3. Temporary roofing.

**1.3 UNIT PRICES**

- A. Work of this Section is affected by metal deck removal and replacement unit price

**1.4 DEFINITIONS**

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.
- B. Full Roof Tear-off: Removal of existing roofing system down to existing roof deck
- C. Partial Roof Tear-Off: Removal of selected components and accessories from existing roofing system.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, sections, and details.
- C. Temporary Roofing Submittal: Product data and description of temporary roofing system. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer, stating acceptance of the temporary roof and that its inclusion does not adversely affect the roofing system's resistance to fire and wind.

**1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
  - 1. Include certificate that Installer is approved by warrantor of proposed roofing system.
- B. Fastener pull-out test report.
- C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

- D. Landfill Records: Indicate receipt and acceptance of demolished roofing materials and hazardous wastes, such as asbestos-containing materials, by a landfill facility licensed to accept them.

### **1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: Approved by warrantor of existing roofing system to work on existing roofing.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Reroofing Conference: Conduct conference at Project site.
  - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer, including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing, including installers of roof deck, roof accessories, and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing system tear-off and replacement, including, but not limited to, the following:
    - a. Reroofing preparation, including roofing system manufacturer's written instructions.
    - b. Temporary protection requirements for existing roofing system components that are to remain.
    - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
    - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
    - e. Existing roof deck conditions requiring notification of Architect.
    - f. Existing roof deck removal procedures and Owner notifications.
    - g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
    - h. Structural loading limitations of roof deck during reroofing.
    - i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
    - j. HVAC shutdown and sealing of air intakes.
    - k. Asbestos removal and discovery of asbestos-containing materials.
    - l. Governing regulations and requirements for insurance and certificates if applicable.
    - m. Existing conditions that may require notification of Architect before proceeding.

### **1.8 FIELD CONDITIONS**

- A. Existing Roofing System: EPDM roofing.

## **PREPARATION FOR REROOFING**

- B. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations are not disrupted. Provide Owner with not less than **72** hours' notice of activities that may affect Owner's operations.
  - 1. Coordinate work activities daily with Owner so Owner can place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
  - 2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.
- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
  - 1. Remove only as much roofing in one day as can be made watertight in the same day.
- F. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work. Existing roof will be left no less watertight than before removal.
  - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

## **1.9 WARRANTY**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
  - 1. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

## **PART 2 - PRODUCTS**

### **2.1 TEMPORARY PROTECTION MATERIALS**

- A. Plywood: DOC PS1, Grade CD Exposure 1.
- B. OSB: DOC PS2, Exposure 1.

### **2.2 TEMPORARY ROOFING MATERIALS**

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities.

**PART 3 - EXECUTION****3.1 PREPARATION**

- A. Shut off rooftop utilities and service piping before beginning the Work.
- B. Test existing roof drains to verify that they are not blocked or restricted. Immediately notify Architect of any blockages or restrictions.
- C. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- D. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
  - 1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing roofing system components that are to remain.

**3.2 ROOF TEAR-OFF**

- A. Full Roof Tear-Off: Remove existing roofing existing roofing and other roofing system components down to the deck and immediately check for presence of moisture by visually observing substrate that is to remain.
  - 1. Remove roof insulation and cover board.
  - 2. Remove wood blocking and nailers.
  - 3. Remove base flashings and counter flashings.
  - 4. Remove perimeter edge flashing and gravel stops.
  - 5. Remove copings.
  - 6. Remove expansion-joint covers.
  - 7. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
  - 8. Remove roof drains indicated on Drawings to be removed.
  - 9. Remove excess asphalt from steel deck that is exposed by removal of wet or damp materials.

**3.3 DECK PREPARATION**

- A. Inspect deck after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect. Do not proceed with installation until directed by Architect.
- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

**PREPARATION FOR REROOFING**

- D. Provide additional deck securement as indicated on Drawings.
- E. Replace steel deck as indicated on Drawings.
- F. Replace steel deck as directed by Architect. Deck replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

**3.4 BASE FLASHING REMOVAL**

- A. Remove existing base flashings. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 076200 Sheet Metal Flashing and Trim.
- C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

**3.5 DISPOSAL**

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
  - 1. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

**END OF SECTION**





## SECTION 07530 – ADHERED EPDM ROOFING

### PART 1 GENERAL

#### 1.1 DESCRIPTION

- A. The project consists of installing a Fully Adhered Reinforced EPDM as outlined. Apply the Adhered EPDM Roofing System in conjunction with polyisocyanurate insulation and coverboard after tear off of the existing EPDM roof to expose the metal deck for verification of suitable substrate as specified in this specification.
- B. Related Sections include the following:
  - 1. Division 1 Section 01230 - "Alternates"
    - a. Base Bid is 60 mil, 20 year warranty
    - b. Add Alternate is 90 mil, 30 year warranty
  - 2. Division 6 Section "Rough carpentry" for wood nailers, cants, curbs, and blocking
  - 3. Division 7 Section "preparation for Re-Roofing" for preparation of existing substrates
  - 4. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counter flashings.
  - 5. Division 23 Section for roof penetrations associated with HVAC work.

#### 1.2 EXTENT OF WORK

- A. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of a Reinforced 60-or 90 mil thick EPDM membrane Adhered Roofing System including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details.
- B. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.
- C. The roofing contractor shall confirm all given information and advise the building owner, prior to bid, of any conflicts that will affect their cost proposal.

#### 1.3 SUBMITTALS

- A. Prior to starting work, the roofing contractor must submit the following:
  - 1. Shop drawings showing layout, details of construction and identification of materials.
  - 2. Sample of the manufacturer's Total Systems Warranty covering all components of the roofing system.
  - 3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
  - 4. Certification of the manufacturer's warranty reserve.
- B. Upon completion of the installed work, submit copies of the manufacturer's final inspection report to the specifier prior to the issuance of the manufacturer's warranty.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.
- B. Comply with the manufacturer's written instructions for proper material storage.
  - 1. Store materials between 60°F and 80°F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60°F minimum temperature before using.
  - 2. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.
- C. Insulation and underlayment products must be on pallets, off the ground and tightly covered with waterproof materials. Manufacturer's wrap does not provide sufficient waterproofing. Insulation

and underlayment products that become wet or saturated are to be discarded.

- D. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense.

### 1.5 WORK SEQUENCE

- A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.
- B. Do not disrupt activities in occupied spaces.

### 1.6 USE OF THE PREMISES

- A. Before beginning work, the roofing contractor must secure approval from the building owner's representative for the following:
  - 1. Areas permitted for personnel parking.
  - 2. Access to the site.
  - 3. Areas permitted for storage of materials and debris.
  - 4. Areas permitted for the location of cranes, hoists and chutes for loading and unloading materials to and from the roof.
- B. Interior stairs or elevators may not be used for removing debris or delivering materials, except as authorized by the building superintendent.

### 1.7 EXISTING CONDITIONS

If discrepancies are discovered between the existing conditions and those noted on the drawings, immediately notify the owner's representative by phone and solicit the manufacturer's approval prior to commencing with the work. Necessary steps shall be taken to make the building watertight until the discrepancies are resolved.

### 1.08 PRE-CONSTRUCTION CONFERENCE

- A. Prior to bid submittal, the roofing contractor should schedule a job site inspection to observe actual conditions and verify all dimensions on the roof. The job site inspection may occur on the day of the pre-bid meeting or prior to such a meeting. Should access to the roof be necessary before or after the pre-bid meeting, the contractor must contact the owner's representative, to coordinate an appropriate time.
- B. Any conditions which are not shown on the shop drawings should be indicated on a copy of the shop drawing and included with bid submittal if necessary to clarify any conditions not shown.

### 1.9 TEMPORARY FACILITIES AND CONTROLS

- A. Temporary Utilities:
  - 1. Water, power for construction purposes and lighting are available at the site and will be made available to the roofing contractor.
  - 2. Provide all hoses, valves and connections for water from source designated by the owner when made available.
  - 3. When available, electrical power should be extended as required from the source. Provide all trailers, connections and fused disconnects.
- B. Building Site:
  - 1. The roofing contractor shall use reasonable care and responsibility to protect the building and site against damages. The contractor shall be responsible for the correction of any damage incurred as a result of the performance of the contract.
  - 2. The roofing contractor shall remove all construction debris from the job site in a timely and legally acceptable manner so as to not detract from the aesthetics or the functions of the building.
- C. Security:

Obey the owner's requirements for personnel identification, inspection and other security measures.

**1.10 JOB SITE PROTECTION**

- A. The roofing contractor shall adequately protect building, paved areas, service drives, lawn, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion. The contractor shall repair or be responsible for costs to repair all property damaged during the roofing application.
- B. During the roofing contractor's performance of the work, the building owner will continue to occupy the existing building. The contractor shall take precautions to prevent the spread of dust and debris, particularly where such material may sift into the building. The roofing contractor shall provide labor and materials to construct, maintain and remove necessary temporary enclosures to prevent dust or debris in the construction area(s) from entering the remainder of the building.
- C. Do not overload any portion of the building, either by use of or placement of equipment, storage of debris, or storage of materials.
- D. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.
- E. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drain.
- F. Store moisture susceptible materials above ground and protect with waterproof coverings.
- G. Remove all traces of piled bulk materials and return the job site to its original condition upon completion of the work.

**1.11 SAFETY**

- A. The roofing contractor shall be responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements that are safety related. **Safety shall be the responsibility of the roofing contractor.** All related personnel shall be instructed daily to be mindful of the full time requirement to maintain a safe environment for the facility's occupants including staff, visitors, customers and the occurrence of the general public on or near the site.

**1.12 WORKMANSHIP**

- A. Applicators installing new roof, flashing and related work shall be factory trained and approved by the manufacturer they are representing.
- B. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications and to the building owner's satisfaction.
- C. There shall be a supervisor on the job site at all times while work is in progress.
- D. All field seams and flashing details are to be completed according to manufacturer's specifications and details by the end of each work day.

**1.13 QUALITY ASSURANCE**

- A. The EPDM Roofing System must achieve a UL Class A.
- B. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
- C. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least five (5) years successful experience installing single-ply EPDM roofing systems and having installed at least one (1) EPDM roofing application or several similar systems of equal or greater size within one year.
- D. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Always provide at least one thoroughly trained and experienced superintendent on the job while roofing work is in progress.
- E. There shall be no deviations made from this specification or the approved shop drawings without

the prior written approval of the specifier. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the specifier's consideration.

- F. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to identify any needed corrective repairs that will be required for warranty issuance. Notify the building owner seventy-two (72) hours prior to the manufacturer's final inspection.
- G. Inspector shall be employed and trained by the manufacturer and have received product-specific training from the manufacturer of the products.

#### 1.14 JOB CONDITIONS, CAUTIONS AND WARNINGS

Refer to manufacturer's EPDM Roofing System specification for General Job Site Considerations.

- A. Safety Data Sheets (SDS) must be on location at all times during the transportation, storage and application of materials.
- B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.
- C. When loading materials onto the roof, the Manufacturer's Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.
- D. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- E. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
- F. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.
- G. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- H. New roofing shall be complete and weathertight at the end of the work day.
- I. Contaminants such as grease, fats and oils shall not be permitted to come in direct contact with the roofing membrane. An overlay of Epichlorohydrin membrane must be adhered around units which have the potential to emit solvents, grease or oil.

#### 1.15 WARRANTY

- A. Provide manufacturer's 20 year Total System Warranty covering both labor and all materials with no dollar limitation. The maximum wind speed coverage shall be peak gusts of 95 mph measured at 10 meters above ground level. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.
- B. Warranty shall also cover leaks caused by accidental punctures: 16 man-hours per year for 60-mil EPDM reinforced membranes.
- C. Warranty shall also cover leaks caused by hail:
  1. Hail up to 1" or 2" diameter when 90-mil EPDM is installed over Dens Deck Prime with adhesive (For Adhered Systems Only) (ADD ALT. SYSTEM IS 90 MIL).
  2. Hail up to 1" diameter when 60-mil EPDM installed over Dens Deck Prime, with adhesive (For Adhered Systems Only).
- D. Pro-rated System Warranties shall not be accepted.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. All components of the specified roofing system shall be products of the EPDM membrane manufacturer.
- B. Unless otherwise approved by the specifier and accepted by the membrane manufacturer, all products (including insulation, fasteners, fastening plates and edgings) must be **manufactured**

## ADHERED EPDM ROOFING

and supplied by the roofing system manufacturer and covered by the warranty.

## 2.2 MEMBRANE

- A. Furnish 60-mil or 90-mil thick EPDM (Ethylene, Propylene, Diene Terpolymer) in the largest sheet possible with 3" or 6" Factory-Applied Tape (FAT). (Splice tape shall be a butyl/EPDM based polymer with a minimum thickness of 25-mil.) The membrane shall conform to the minimum physical properties of ASTM D4637. When a 10 foot wide membrane is to be used, the membrane shall be manufactured in a single panel with no factory splices to reduce splice intersections.
1. EPDM Sheet: ASTM D4637/D4637M, Type II fabric internally reinforced, EPDM sheet.
    - a. Manufacturers:
      1. Carlisle SynTec Systems
      2. Johns Manville, Inc.
      3. Manufacturer and product approved by the Owner as being as being acceptable equivalent.
    2. Thickness: 60 mils
    3. Exposed Face Color: Black

## 2.3 INSULATION/UNDERLAYMENT

- A. When applicable, insulation shall be installed in multiple layers. The first and second layer of insulation shall be mechanically fastened or adhered to the substrate in accordance with the manufacturer's published specifications.
- B. Insulation shall be **Polyisocyanurate** as supplied by manufacturer allowed by Membrane Manufacturer to maintain stated warranty. Minimum R-value required is R-30. (Insulation must meet ASHRAE 90.1 minimums per IBC-International Building Code.)
1. **Polyisocyanurate** – A foam core insulation board covered on both sides with a medium weight fiber-reinforced felt facer meeting ASTM C 1289-06, Type II, Class 1, Grade 2 (20 psi) or Grade 3 (25 psi). The product is available in 4' x 8' standard size with a thickness from 1 to 4 inches. 4' x 4' tapered panels are also available.
  2. **Dens Deck Prime** – gypsum core that incorporates glass-mat facings on the top and bottom side. The top surface is pre-primed and provides excellent bond strength for adhered membrane for use as a cover board. Available in 1/4" to 5/8" and 4' x 4' or 4' x 8' size boards. Thickness used in project to be in accordance with cover material thickness and warranty to be applied.

## 2.4 FASTENING COMPONENTS

- A. **Insulation Adhesives**
1. **Flexible Adhesive:** An elongating impact resistant two component insulating urethane adhesive used to attach insulation.
    - a. MDI content of Part A material less than 25%
    - b. Adhere base layer of insulation in accordance with requirements for specified Windstorm Resistance Classification and SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity.
- B. **Fasteners, Plates and Bars**
1. **Pre-Assembled Fasteners:** A pre-assembled 3" diameter metal Plate and # 12 threaded fastener with a #3 drive used for insulation attachment into steel or wood decks. Installed using OMG Fastening Tools.
  2. **Fasteners:** a threaded, #14 fastener with a #3 phillips drive used with steel and wood roof decks
  3. **Insulation Fastening Plates:** a nominal 3 inch diameter plastic or metal plate used for insulation attachment.
  4. **Term Bar Nail-Ins:** A 1-1/4" long expansion anchor with a zinc plated steel drive pin used for fastening the Termination Bar or Seam Fastening Plates to concrete, brick, or block walls.

**2.5 ADHESIVES, CLEANERS AND SEALANTS**

All products shall be furnished by the roofing manufacturer and specifically formulated for the intended purpose and compatible with other roofing components.

- A. **Low VOC Bonding Adhesive:** A low VOC (volatile organic compound) bonding adhesive (less than 250 grams/liter) used for bonding Sure-Seal/Sure-White EPDM membranes to various surfaces. This product meets the <250 gpl VOC (volatile organic compound) content requirements of the OTC Model Rule for Single Ply Roofing Adhesives. Available in 5 gallon pails.
- B. **Low-VOC EPDM Primer** - A low VOC (volatile organic compound) primer (less than 250 grams/liter) for use with SecurTape or Pressure-Sensitive products. Available in 1 or 3 gallon pails and as CAV-PRIME Pressurized Cylinders.
- C. **Lap Sealant:** A heavy-bodied material used to seal the exposed edges of a membrane splice. Available in tubes.
- D. **Water Cut-Off Mastic:** A one-component, low viscosity, self wetting, Butyl blend mastic used to achieve a compression seal between the EPDM membrane or Elastoform Flashing and applicable substrates. Available in tubes.
- E. **One-Part Pourable Sealer:** Available in black or white, a one-component, moisture curing, elastomeric polyether sealant used for attaching lightning rod bases and ground cable clips to the membrane surface and as a sealant around hard-to-flash penetrations such as clusters of pipes.

**2.6 METAL EDGING AND MEMBRANE TERMINATIONS**

- A. **General:** All metal edgings shall be tested and meet ANSI/SPRI ES-1 standards and comply with International Building Code. All metal work is to be supplied and warranted by the manufacturer. The intent is to remove and re-use existing coping due to color differences between new and existing materials.
  1. **Continuous Cleat Coping:** a coping or fascia, snap-on edge system consisting of a 24 gauge galvanized metal water dam and .040", thick Kynar 500 Metal fascia color shall match existing metal roofing material. ANSI/SPRI ES-1 Certified. Coping FM Approved 1-90.
  2. **Termination Bar:** a 1" wide and .098" thick extruded aluminum bar pre-punched 6" on center; incorporates a sealant ledge to support Lap Sealant and provide increased stability for membrane terminations.

**2.7 WALKWAYS**

- A. Protective surfacing for roof traffic shall be EPDM Pressure-Sensitive Walkway Pads (with Factory-Applied Tape on the underside of the walkway) adhered to the membrane surface in conjunction with appropriate Primer.

**PART 3 EXECUTION****3.1 GENERAL**

- A. Comply with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.
- B. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

**3.2 INSULATION PLACEMENT**

- A. Install insulation or membrane underlayment over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch. Stagger joints both horizontally and vertically if multiple layers are provided.
- B. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive Flexible Adhesive in accordance with the manufacturer's specifications.

**3.3 MEMBRANE PLACEMENT AND BONDING**

- A. Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour before bonding. Fold the sheet back onto itself so half the underside of the membrane is exposed.

- B. Apply the Bonding Adhesive in accordance with the manufacturer's published instructions and coverage rates, to both the underside of the membrane and the substrate. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
  - 1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.
  - 2. Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.
- C. Install adjoining membrane sheets in the same manner, overlapping edges approximately 4 inches. Do not apply bonding adhesive to the splice area.

### 3.4 MEMBRANE SPLICING

- A. Position membrane sheet to allow for required splice overlap. Mark the bottom sheets with an indelible marker approximately 1/4" to 1/2" from the top sheet edge. The pre-marked line on the membrane edge can also be used as a guide for positioning splice tape.
- B. When the membrane is contaminated with dirt, fold the top sheet back and clean the dry splice area (minimum 3" wide) of both membrane sheets by scrubbing with clean natural fiber rags saturated with Sure-Seal Weathered Membrane Cleaner. When using Sure-Seal (black) PRE-KLEENED membrane, cleaning the splice area is not required unless contaminated with field dirt or other residue.
- C. Apply EPDM Primer to splice area and permit to flash off. Primer must be applied to both the top membrane layer and the bottom membrane layer.
- D. When adhering Factory Applied Tape (FAT), pull the poly backing from FAT beneath the top sheet and allow the top sheet to fall freely onto the exposed primed surface. Press top sheet on to the bottom sheet using firm even hand pressure across the splice towards the splice edge
- E. For end laps, apply 3" or 6" seam tape to the primed membrane surface in accordance with the manufacturer's specifications. Remove the poly backing and roll the top sheet onto the mating surface.
- F. Tape splices must be a minimum of 2-1/2" wide using 3" wide (Butyl/EPDM) seam tape that is a minimum 25-mil thick. seam tape must extend 1/8" minimum to 1/2" maximum beyond the splice edge. Field splices at roof drains must be located outside the drain sump.  
Note: For projects where a 90-mil membrane OR 20-year or longer System Warranty is specified, splice enhancements are required. Refer to Manufacturer's Roofing System Specification.
- G. Immediately roll the splice using positive pressure when using a 2" wide steel roller. Roll across the splice edge, not parallel to it. When FAT is used, Stand-Up Seam Roller can be used to roll parallel to the splice edge.
- H. At all field splice intersections, apply Lap Sealant along the edge of the membrane splice to cover the exposed seam tape 2" in each direction from the splice intersection. Install Pressure-Sensitive "T" Joint Covers or a 6" wide section (with rounded corners) of Pressure-Sensitive Elastoform Flashing over the field splice intersection.

### 3.5 FLASHING

- A. Wall and curb flashing shall be cured EPDM membrane. Continue the deck membrane as wall flashing where practicable. Use Pressure-Sensitive Curb Wrap when possible to flash curb units.
- B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

### 3.6 WALKWAYS

- A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the specifier's drawing.
- B. Adhere walkways pads or rubber pavers to the EPDM membrane in accordance with the manufacturer's specifications.

**3.7 DAILY SEAL**

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed.

**3.9 CLEAN UP**

- A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

**END OF SPECIFICATION**



SECTION 076200 - SHEET METAL FLASHING AND TRIM

**PART 1 - GENERAL**

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 07 90 00 - Joint Sealers.
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.
4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at the Project site

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.

7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
  8. Details of roof-penetration flashing.
  9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
  10. Details of special conditions.
  11. Details of connections to adjoining work.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.
- D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- E. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.
1. Sheet Metal Flashing and Trim: Manufacturers' standard size. Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For copings and roof edge flashing, from ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.
- D. Qualification Statements: For fabricator.
- E. Sample warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers.
- C. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested, shop is to be listed as able to fabricate required details as tested and approved.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
  - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
  - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

## 1.8 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

## 1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Finish Warranty Period: **20** years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
  - 1. Design Pressure:  $V_{asd} = 93$ .
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

### 2.2 SHEET METAL MATERIALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

- B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
1. Nominal Thickness: 0.034 inch.
  2. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
  3. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 7 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  4. Color: As selected by Architect from manufacturer's full range to match or complement existing roof metal.
  5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
  6. Exposed Coil-Coated Finish:
    - a. finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  7. Color: As selected by Architect from manufacturer's full range. Finish in "Concealed Finish" Subparagraph below is often retained as a factory-applied finish for interior-facing surfaces of coil-coated sheet. Usually delete for other finishes.
  8. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil

### 2.3 UNDERLAYMENT

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

- b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
  - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width..
2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
- 1. Material: Galvanized steel, 0.022 inch thick.
  - 2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  - 3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
  - 4. Accessories:
    - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
  - 5. Finish: With manufacturer's standard color coating
- 2.4 FABRICATION, GENERAL
- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
- 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

## 2.5 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.

2. Fabricate in minimum 96-inch- long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. .
5. Gutter Profile: **Style A** in accordance with cited sheet metal standard (match existing profile and size).
6. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
  - a. Aluminum-Zinc Alloy-Coated Steel: 0.034 inch thick.

B. Downspouts: Fabricate **rectangular** downspouts to match existing locations and as indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Hanger Style: Rectangular – match profile of downspout.
2. Fabricate from the following materials:
  - a. Aluminum-Zinc Alloy-Coated Steel: **0.022 inch** thick.

## 2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12 ft.- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight.

1. Joint Style: Butted with expansion space and 6-inch- wide, exposed cover plate.
2. Fabricate from the following materials:
  - a. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
  - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of **sealant**.
  - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
  - 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
  - 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
  - 8. Do not field cut sheet metal flashing and trim by torch.
  - 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

## SHEET METAL FLASHING AND TRIM



1. Space movement joints at maximum of **10 ft.** with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by Fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
  1. Use sealant-filled joints unless otherwise indicated.
    - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    - b. Form joints to completely conceal sealant.
    - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    - d. Adjust setting proportionately for installation at higher ambient temperatures.
      - 1) Do not install sealant-type joints at temperatures below 40 deg F
  2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

### 3.3 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters:
  1. Join sections with joints sealed with sealant.
  2. Provide for thermal expansion.
  3. Attach gutters at eave or fascia to firmly anchor them in position.
  4. Provide end closures and seal watertight with sealant.
  5. Slope to downspouts.
  6. Fasten gutter spacers to front and back of gutter.
  7. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
  8. Anchor gutter with gutter brackets spaced not more than 36 inches apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
  9. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft apart. Install expansion-joint caps.

10. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 18 inches apart.
11. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft. apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

3.4 Insert specific installation requirements here for other sheet metal flashing and trim items specified in this Section if required.

3.5 INSTALLATION TOLERANCES

- A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING

- A. Clean and neutralize flux materials. Clean off excess solder.  
B. Clean off excess sealants.

3.7 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.  
B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.  
C. Maintain sheet metal flashing and trim in clean condition during construction.  
D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

## **SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes general provisions covering the contract documents for HVAC Systems.

#### **1.3 DEFINITIONS**

- A. Provide shall mean "Furnish, install and connect."
- B. Piping shall mean "pipe installed with all specified fittings, valves and accessories, and forming a complete system."
- C. HVAC shall mean "Heating, Ventilation and Air Conditioning."

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Electrical Coordination Drawings: In addition to submittal requirements of other Division 23 Sections, submit a document approved by the project Electrical Contractor certifying that all mechanical equipment being furnished under Division 23 complies with the electrical characteristics of the source power which will be furnished under Division 26.
- B. Model numbers listed on the Mechanical Contract Documents shall not be construed to indicate electrical characteristics. Electrical characteristics of mechanical equipment shall be as indicated on the Electrical Contract Documents.
- C. Review of Submittals does not relieve the Contractor of any of the requirements of the Contract Documents. Failure by the Engineer to document errors and omissions in the Contractor's submittals during the Engineer's submittal review does not constitute a waiver of any of the requirements of the original Contract Documents.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Installation Instructions: Two binders containing manufacturer's installation instructions for all equipment furnished under Division 23 shall be furnished by the Contractor. One binder shall be kept in the General Contractor's office at the job site. The other binder shall be delivered to the Engineer upon acceptance by the Architect of the Submittals.

- B. Operation and Maintenance Instructions: Three copies of equipment O&M manuals contained in rigid 3-ring binders shall be submitted to the Owner a minimum of 15 days prior to equipment/systems training. Binders shall have permanent labels on the spine and front cover indicating project name, project number, building name and contents. Model and serial numbers of equipment shall be shown on the cover of their respective O&M manual(s).

## 1.6 QUALITY ASSURANCE

- A. HVAC Installer Qualifications:
  - 1. HVAC Subcontractor shall have a current Class II Conditioned Air Contractors License for the state in which the project is being constructed. The Subcontractor shall have as part of the Firm a Service Department qualified to service all systems installed in the project, or have a written agreement with a Service Agency qualified to provide such service. The Service Department or Agency shall be on call at all hours.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Material storage
  - 1. All materials and equipment stored on the jobsite shall be elevated above the ground and stored under suitable weather cover. Materials and equipment shall not be stored in areas subjected to localized flooding.
  - 2. Manufacturer's original shipping packaging and protective coverings shall be left in place until the equipment is prepared for installation.
- B. Electrical enclosure protection
  - 1. During construction, all protective covers and other devices shall be left in place that protect against inadvertent contact with live electrical circuits.
  - 2. All warning labels related to electrical and rotating equipment hazards shall be in place prior to energizing mechanical equipment circuits.
- C. Protection of ductwork and piping
  - 1. Maintain temporary closures on the ends of all ductwork and piping as the installation work progresses. Temporary closures include plastic sheeting, tape and appropriate caps and covers.
  - 2. Where debris enters piping during installation, steps shall be taken to clean the interior of the pipe prior to placing in service.
  - 3. Where debris enters ductwork during installation the duct interior shall be cleaned prior to placing in service.
  - 4. All lined ductwork shall be kept clean and dry. Any lined duct must be removed from the job site if moisture is discovered in installed or stored ductwork.
- D. Roof protection: All penetrations through roofs, including roof curbs, piping curbs and roof drainage system elements shall be properly protected during construction to

prevent water intrusion into the building. Protective measures could include temporary covers and plugs, as well as other appropriate temporary elements.

### **1.8 PRIOR APPROVALS**

- A. Manufacturers References: When reference is made in the Contract Documents to trade names or specific manufacturers and/or models, such reference, unless noted otherwise, is made to designate and identify the quality of materials or equipment to be furnished and is not intended to restrict competitive bidding. If it is desired to use materials or equipment different from those indicated on the Contract Documents, written request for approval must be received by the Architect at least TEN DAYS prior to the date set for the opening of bids. A copy of the request should also be sent directly to the Engineer. Requests for prior approval of a proposed substitute shall be accompanied by complete technical data supporting the request.
- B. Request for Prior Approval by facsimile transmission (fax) will not be considered. Prior approval requests shall be submitted in hard copy or email format only.

### **1.9 PERMITS AND FEES**

- A. Obtain all necessary Permits and Inspections required for the installation of this work and pay all charges incident thereto. Deliver to the Architect all certificates of inspection issued by authorities having jurisdiction.

### **1.10 SAFETY**

- A. OSHA Requirements applicable to the project shall be complied with at all times.
- B. Manufacturer's Safety Instructions shall be followed in all instances.
- C. Asbestos Containing Materials (ACM) shall not be used on this project.
- D. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21 inch diameter sphere and shall comply with the loading requirements for guards specified in the International Building Code.

### **1.11 ENVIRONMENT**

- A. Refrigerants containing CFC's or HCFS's shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

**1.12 FIELD CONDITIONS**

- A. Electrical Equipment Clearances: Piping, equipment and other mechanical installations shall not be located within 42" of the front or 36" of the side of any electrical switchboards, panelboards, power panels, motor control centers, electrical transformers or similar electrical equipment. Piping and ductwork shall not pass through or above electrical equipment rooms except as required to serve those rooms.
- B. Layout:
1. The equipment listed on the Drawings is considered basis of design equipment and has been used for the physical arrangement of the mechanical systems. When other equipment listed in the specifications as acceptable, equal or equipment which has received "prior approval" is used, it shall be the Contractor's responsibility to provide structural, ductwork, electrical, service clearances, or other changes required to accommodate the substituted equipment. Changes to use non basis of design equipment shall be made at no additional cost to the Owner. Submit a list of required changes along with all prior approval requests and shop drawing submittals.
  2. The Contract Drawings are intended to show the general arrangement of all mechanical work. They do not show in detail all offsets, fittings and transitions. Examine Drawings, investigate site conditions to be encountered and arrange work accordingly. Furnish all offsets and transitions required for a complete and functional installation.
  3. Drawings do not indicate in detail exact configuration of connections for fixtures, equipment and accessories. Final connection shall be as shown on approved Manufacturer's Submittal Drawings. Where Manufacturer's Submittal Drawings conflict with the Contract Documents, consult with the Architect for resolution.
- C. Measurement of Drawings by scale shall not be used as dimensions for fabrication. Measurements for locating fixtures, equipment, ductwork, piping and other mechanical items shall be made on the site and shall be based on actual job site conditions.
- D. Check spatial limitations and verify electrical requirements before ordering any mechanical equipment or materials. Before ordering materials or fabricating ductwork and piping, notify Architect if conflicts are detected with other building components. Place large equipment inside the building prior to the erection of exterior walls where equipment cannot enter finished building openings.
- E. Coordination: Mechanical work shall be coordinated with that of other trades to avoid conflict. The Contractor shall study all plans and specifications for this project and shall notify the Architect of any conflict between work under Division 23 and work under other divisions of the Project. Particular attention shall be given to interference between piping, electrical installations, structural systems, building openings and ductwork.
- F. Failure to accurately and timely coordinate with other trades for installation of mechanical systems shall not result in additional charges to the owner, architect or engineer.

**GENERAL MECHANICAL PROVISIONS**

### **1.13 CODES AND STANDARDS**

- A. Mechanical installations shall conform to the latest edition or the addition approved by the authority having jurisdiction of the following, in addition to any other mentioned Codes and Standards.
1. The International Building Code.
  2. The International Mechanical Code.
  3. The International Plumbing Code
  4. The State Energy Code
  5. The International Fire Protection Code
  6. NFPA Standard 13, Installation of Sprinkler Systems.
  7. NFPA Standard 70, National Electric Code.
  8. NFPA Standard 90A, Installation of Air Conditioning and Ventilation Systems.
  9. NFPA Standard 101, Code for Safety to Life for Fire in Buildings and Structures.

### **1.14 USE OF MECHANICAL SYSTEMS DURING CONSTRUCTION**

- A. The operation of the permanent HVAC systems during the construction process is strongly discouraged. However, the Contractor may take measures to protect the systems from contamination if they are operated.
- B. Under no circumstances shall the HVAC system be operated while sanding of any kind is taking place on the jobsite.
- C. When placed in operation during the construction period, all HVAC systems shall have MERV 8 filtration in all standard filter racks throughout the systems. Where so equipped, final filter banks do not have to be in place.
- D. All return openings and outdoor air intake openings shall be protected with MERV 8 filter material at all points of entry into the duct system. These protections shall be maintained and remain in place until the building is prepared for final inspection. Failure to comply will result in contractor being required to clean ductwork prior to final acceptance.
- E. The interior of all HVAC units shall be thoroughly cleaned to "like-new" condition prior to final acceptance of the building HVAC systems. New, clean filters shall be furnished in all new equipment.

### **1.15 INTERRUPTION OF EXISTING SERVICES**

- A. Exercise care so as not to cut any existing utilities or services. Where an existing utility line or service line is cut it shall be repaired to "like-new" condition. Interruption of service shall not be made without prior written permission of the Owner.

### **PART 2 - PRODUCTS (Not applicable for this section.)**

**PART 3 - EXECUTION (Not applicable for this section.)**

**END OF SECTION**



## **SECTION 23 05 00 - BASIC MECHANICAL MATERIALS AND METHODS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes the following basic mechanical materials and methods to complement other mechanical sections.
  1. Non-shrink grout for equipment installations.
  2. Fire stopping.
  3. Installation requirements common to equipment specification sections.
  4. Touchup painting and finishing.
  5. Cutting and Patching.
- B. See individual piping sections for pipe and pipe fitting materials.

#### **1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

#### **1.4 SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract.
- B. Prepare coordination drawings of Mechanical Rooms to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of mechanical equipment

and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
  - a. Planned piping layout, including valve and specialty locations and valve stem movement.
  - b. Planned duct systems layout, including elbow radii and duct accessories.
  - c. Clearances for installing and maintaining insulation.
  - d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
  - e. Equipment service connections and support details.
  - f. Exterior wall and foundation penetrations.
  - g. Fire-rated wall and floor penetrations.
  - h. Sizes and location of required concrete pads and bases.
2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

## **1.5 QUALITY ASSURANCE**

- A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.
- B. Coordinate all electrical service requirements for mechanical equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 16. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

## **1.6 SEQUENCING AND SCHEDULING**

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

- C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- E. Coordinate connection of electrical services.
- F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.
- H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

## **PART 2 - PRODUCTS**

### **2.1 GROUT**

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
  - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory-packaged.

### **2.2 FIRE STOPPING**

- A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Products: Subject to compliance with requirements, provide products by one of the following:
  - 1. Dow Corning Corp.
  - 2. 3M Corporation
  - 3. General Electric Co.
  - 4. Standard Oil Engineered Materials Co.
  - 5. Hilti, Inc.
  - 6. Tremco Corp.

**PART 3 - EXECUTION****3.1 GROUTING**

- A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout to completely fill equipment bases.
- F. Place grout on concrete bases to provide a smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's printed instructions.

**3.2 FIRESTOPPING**

- A. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials

**3.3 COMMON INSTALLATION REQUIREMENTS**

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of mechanical systems. Indicated locations and arrangements were used to size ductwork and pipe; and calculate friction loss, expansion, pump sizing, and other design considerations. Install ductwork and piping as indicated, except where deviations to layout are approved on coordination drawings.
- B. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
- C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.
- D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- E. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

- F. Install equipment giving right-of-way to piping systems installed at a required slope.

### **3.4 PAINTING AND FINISHING**

- A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.

**END OF SECTION**



## **SECTION 23 05 12 - MOTOR CONTROLLERS FOR HVAC EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes ac motor control devices for mechanical equipment that are supplied as enclosed units.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include material descriptions, dimensions of individual components and profiles.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: To include in maintenance manuals.

#### **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: Maintain, within 150 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Comply with NFPA 70.
- C. Comply with UL 508 and 508A
- D. Comply with NEMA ICS-2, 2000
- E. Comply with IEC 60947-5, 60947-4, 60947-3

- F. Listing and Labeling: Provide motor controllers specified in this Section that are listed and labeled.

- 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

## 1.7 COORDINATION

- A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

## 1.8 WARRANTY

- A. Manufacturer shall provide a five-year warranty on the complete starter assembly for single phase starters and magnetic motor controllers.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Single Phase Starters and Magnetic Motor Controllers:
    - a. ABB
    - b. Allen-Bradley Co.; Industrial Control Group.
    - c. Cerus Industrial
    - d. Cutler-Hammer Products.
    - e. Danfoss Graham
    - f. General Electric
    - g. Siemens Energy & Automation, Inc.
    - h. Square D.

### 2.2 SINGLE PHASE STARTER

- A. Description: Starters for 115VAC single phase motors less than 1 HP shall be capable of both manual and automatic operation.
- B. NEMA ICS 2, general purpose, Class A.
- C. The single phase motor starter shall consist of a manually operated quick-make toggle mechanism lockable in the "Off" position which shall also function as the motor disconnect. Additionally, the starter shall provide thermal overload protection, run status pilot light and fault pilot light. The starter must include the capability to operate



in both manual and automatic control modes. In automatic mode, the starter shall have the capability to integrate with a building automation system by providing terminals for run input, run status output and fault output. All control terminals shall be integrated in the starter. At a minimum, each single phase starter shall include an interposing run relay and current sensing status output relay. Single phase motor starter shall be in a surface mount enclosure.

- D. Starters for single phase motors not automatically started shall be manual type with thermal protection.

## 2.3 MAGNETIC MOTOR CONTROLLERS

### A. GENERAL

1. Combination starters shall be furnished for all three phase motors, (unless specifically noted otherwise) and single phase motors which are automatically started.
2. Starters shall be NEMA type and shall provide protection on all three phases.
3. Combination Starters: Provide combination magnetic starters for all motors requiring branch circuit protection or a line-of-sight disconnect in addition to starter.

### B. ENCLOSED FULL VOLTAGE NON-REVERSING (FVNR) NON-COMBINATION STARTER

1. Magnetic Motor Starters shall be enclosed in a general purpose electrical enclosure with the appropriate environmental rating.
2. Starters shall consist of a horsepower rated magnetic contactor with a minimum of 2NO and 2NC auxiliary contacts and solid state electronic overload relay.
3. Overload relay shall protect all three phases with a wide range 1-40 amp current setting and trip class to allow field adjustment for specific motor FLA. Interchangeable heater elements are not acceptable.
4. Overload relay shall incorporate SmartStart Technology, or the following protective functions:
  - a. Out of calibration protection (if the FLA on the overload is set outside acceptable range, overload will trip to indicate fault event)
  - b. Stall protection
  - c. Max time to start
  - d. Locked Rotor
  - e. Phase Unbalance
  - f. Phase loss
  - g. Cycle Fault
5. Starter shall be field selectable for manual or auto reset to restore normal operation after a trip or fault condition. Manual pushbutton shall be accessible without removing or opening cover on starter.
6. In the event of a power failure, starter shall restart in last mode.
7. All starters must be provided with a universal power supply capable of a 208 to 600 volt input range. The power supply must accept the available line voltage and the control voltage shall not exceed 24V.

8. Installed accessories shall include Hand-Off-Auto operation pushbutton keypad. Include LED pilot light indicators for Hand, Off, Auto, Run and Overload conditions.
9. When remotely controlled by an automation system, the starter shall include remote run terminals which accept both a voltage input signal and a contact closure. The voltage run input shall accept both AC and DC signals from 12-250V to allow direct connection of the transistorized automation signal to the starter.
10. Starter must contain an integral current sensor with NO contact which closes to indicate motor run status as well as a NO contact which closes when an overload trip condition occurs.
11. Each starter shall have an individual control circuit transformer, line voltage primary, 120 volt secondary, with one fuse in the ungrounded side of the secondary. The transformer shall have 100% space capacity. Where electrical interlocking is involved, a separate contact on the circuit breaker disconnect shall open the interlock circuit. All sources of power to each combination starter shall be deenergized when the lockable circuit breaker disconnect is opened.

C. **ENCLOSED FULL VOLTAGE NON-REVERSING (FVNR) COMBINATION STARTER**

1. Enclosed combination starters shall include all of the magnetic starter requirements in addition to a disconnecting method. All disconnects shall include a lock-out mechanism when in the off position.
2. Motor circuit protectors (MCP) shall be provided as the acceptable form of disconnecting means. The MCP shall be a UL listed 508 current limiting manual motor starter with magnetic trip elements only. The MCP shall carry a UL 508F rating (up to 100A frame size) which provides for coordinated short circuit rating for use with the motor contactor and provides a minimum interrupting rating of 30,000 AIC for the combination starter.

## 2.4 ENCLOSURES

- A. Description: Flush or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
  2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

## 2.5 SERVICE CONDITIONS

- A. Ambient temperature, continuous, full speed, full load operation:
1. 14 to 113°F through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt
  2. 14 to 104°F 150 HP and larger
- B. 0 to 95% relative humidity, non-condensing.
- C. Elevation to 3,300 feet without derating.

- D. AC line voltage variation, -10 to +10% of nominal with full output.
- E. No side clearance shall be required for cooling.
- F. All power and control wiring shall be done from the bottom.

## **2.6 ACCESSORIES**

- A. Devices are factory installed in controller enclosure, unless otherwise indicated.
- B. Pilot Lights and "Hand-Off-Auto" Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break push-button station with a factory-applied hasp arranged so a padlock can be used to lock push button in depressed position with control circuit open.
- D. Factory mounted with Nationally Recognized Testing Laboratory listed and labeled mounting device.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.
- D. Hand-Off-Automatic Selector Switches: In covers of controllers of motors started and stopped by automatic controls or interlocked with other equipment. Also, furnish "run" light in cover.

### **3.2 GENERAL INSTALLATION**

- A. Install independently mounted motor-control devices according to manufacturer's written instructions.
- B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.
- C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Division 26 Sections.

- D. Motor-Controller Fuses: Install indicated fuses in each fusible switch.

### **3.3 CONTROL WIRING INSTALLATION**

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
  - 1. Comply with requirements for cable trays specified in Section "Cable Trays for Electrical Systems."
  - 2. Comply with requirements for raceways and boxes specified in Section "Raceways and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Connect hand-off-automatic switch and other automatic control devices where available.
  - 1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
  - 2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, fire-related cutouts and motor overload protectors.

### **3.4 IDENTIFICATION**

- A. Identify motor-control components and control wiring according to other Division 23 Sections.

### **3.5 ADJUSTING**

- A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.6 CLEANING**

- A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

### **3.7 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

**END OF SECTION**



## SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Grout.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

### PART 3 - EXECUTION

#### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.

- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in other Sections.

### 3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete and Masonry Walls above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  2. Interior Concrete or Masonry Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

**END OF SECTION**



## SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
  - 3. Fastener systems.
  - 4. Equipment supports.
- B. Related Sections:
  - 1. Section "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:
  - 1. Equipment supports.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

## 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

### 2.2 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carpenter & Paterson, Inc.
  - 2. Clement Support Services.
  - 3. ERICO International Corporation.
  - 4. National Pipe Hanger Corporation.
  - 5. PHS Industries, Inc.
  - 6. Pipe Shields Inc.
  - 7. Piping Technology & Products, Inc.
  - 8. Rilco Manufacturing Co., Inc.
  - 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

## HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches minimum or 2 ½ times the pipe diameter beyond sheet metal shield for piping operating below ambient air temperature.

### **2.3 FASTENER SYSTEMS**

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### **2.4 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

### **2.5 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## **PART 3 - EXECUTION**

### **3.1 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are

- licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.

- c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.2 EQUIPMENT SUPPORTS**

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### **3.3 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### **3.4 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### **3.5 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.



8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
  - a. Horizontal (MSS Type 54): Mounted horizontally.
  - b. Vertical (MSS Type 55): Mounted vertically.
  - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

**END OF SECTION**



## SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

#### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: White.
  - 3. Background Color: Black.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 5. Minimum Label Size: Length and width vary for required label content.
  - 6. Minimum Letter Size: 1/4 inch

7. Fasteners: Stainless-steel rivets.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### **3.2 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

**END OF SECTION**

## SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Testing, Adjusting, and Balancing Equipment:
    - a. Motors.
    - b. Condensing units.
    - c. Heat-transfer coils.

#### 1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An entity engaged to perform TAB Work.
- G. TDH: Total dynamic head.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

- B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article in Part 3.
- D. Sample report forms.
- E. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.
- F. Certified TAB reports: as specified in "Final Report" Article in Part 3.

## 1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC .
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.
- B. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms certified by the test and balance agent.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

## 1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Contract Document Review:
  - 1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. Notify Architect of any such conditions.
  - 2. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible. Notify Architect if any devices are found to be in inaccessible locations.
  - 3. Examine the approved submittals for HVAC systems and equipment. Notify Architect of any discrepancies found between design contract documents and approved submittals.
- B. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- C. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section "Metal Ducts" and/ or Section "Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- D. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.

- G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. General:
    - a. Permanent electrical-power wiring is complete.
    - b. Automatic temperature-control systems are operational.
    - c. Equipment and duct access doors are securely closed.
    - d. Windows and doors can be closed so indicated conditions for system operations can be met.
  - 2. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable-frequency controllers' startup is complete and safeties are verified.
    - g. Automatic temperature-control systems are operational.
    - h. Ceilings are installed.
    - i. Suitable access to balancing devices and equipment is provided.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.



1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
  3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section "Duct Insulation," Section "HVAC Equipment Insulation," and Section "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section "Metal Ducts."

### **3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS**

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  1. Measure total airflow.
    - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

- b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
  - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
  - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

### 3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

### 3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

### 3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
  2. Airflow.
  3. Entering- and leaving-air temperature at full load.
  4. Voltage and amperage input of each phase at full load and at each incremental stage.
  5. Calculated kilowatt at full load.
  6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
1. Dry-bulb temperature of entering and leaving air.
  2. Airflow.
  3. Air pressure drop.
  4. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
  2. Wet-bulb temperature of entering and leaving air.
  3. Airflow.
  4. Air pressure drop.
  5. Refrigerant suction pressure and temperature.

### 3.9 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
1. Verify temperature control system is operating within the design limitations.
  2. Confirm that the sequences of operation are in compliance with Contract Documents.
  3. Verify that controllers are calibrated and function as intended.
  4. Verify that controller set points are as indicated.
  5. Verify the operation of lockout or interlock systems.
  6. Verify the operation of valve and damper actuators.
  7. Verify that controlled devices are properly installed and connected to correct controller.
  8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
  9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.10 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.

### 3.11 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Fan curves.
  - 2. Manufacturers' test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance; do not include Shop Drawings and product data.
  
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB contractor.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
  - 15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.

- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  3. Test Data (Indicated and Actual Values):
    - a. Total air flow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Filter static-pressure differential in inches wg.
    - f. Preheat-coil static-pressure differential in inches wg.
    - g. Cooling-coil static-pressure differential in inches wg.
    - h. Heating-coil static-pressure differential in inches wg.
    - i. Outdoor airflow in cfm.
    - j. Return airflow in cfm.
    - k. Outdoor-air damper position.
    - l. Return-air damper position.
    - m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Coil identification.
- d. Capacity in Btu/h.
- e. Number of stages.
- f. Connected volts, phase, and hertz.
- g. Rated amperage.
- h. Air flow rate in cfm.
- i. Face area in sq. ft..
- j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

- a. Heat output in Btu/h.
  - b. Air flow rate in cfm.
  - c. Air velocity in fpm.
  - d. Entering-air temperature in deg F.
  - e. Leaving-air temperature in deg F.
  - f. Voltage at each connection.
  - g. Amperage for each phase.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - g. Number, make, and size of belts.
  3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated air flow rate in cfm.



- h. Indicated velocity in fpm.
- i. Actual air flow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary air flow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final air flow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

**3.12 ADDITIONAL TESTS**

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

**END OF SECTION**



## SECTION 23 07 13 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply, return, and outdoor air.
- B. Related Sections:
  - 1. Section "Metal Ducts" for duct liners.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

**1.6 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

**1.7 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

**PART 2 - PRODUCTS****2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.

**DUCT INSULATION**

- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Fibrex Insulations Inc.; FBX.
    - c. Johns Manville; 800 Series Spin-Glas.
    - d. Knauf Insulation; Insulation Board.
    - e. Manson Insulation Inc.; AK Board.
    - f. Owens Corning; Fiberglas 700 Series.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following :
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F.
  3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F.
  3. Solids Content: 60 percent by volume and 66 percent by weight.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
  3. Service Temperature Range: 0 to plus 180 deg F.

## 2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F.
  4. Color: Aluminum.
  5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F.
  4. Color: White.
  5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## DUCT INSULATION

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## **2.6 FIELD-APPLIED FABRIC-REINFORCING MESH**

- A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

## **2.7 FIELD-APPLIED CLOTHS**

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

## **2.8 FIELD-APPLIED JACKETS**

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Adhesive: As recommended by jacket material manufacturer.
  2. Color: White

## **2.9 SECUREMENTS**

- A. Bands:
  1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.
- B. Insulation Pins and Hangers:
  1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.
  2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - b. Spindle: Copper- or zinc-coated, low-carbon steel, Aluminum, Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
    - b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
    - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel, aluminum, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
  6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

## 2.10 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## DUCT INSULATION



### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves per the UL listing of the damper.
1. Comply with requirements in other Sections specifying firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
- F. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeves per the UL listing of the damper.
1. Seal penetrations through fire-rated assemblies. Comply with requirements in other Sections specifying penetration firestopping materials.

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces, or as recommended in manufacturer's printed instructions.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions, or as recommended in manufacturer's printed instructions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

## DUCT INSULATION

### 3.7 FINISHES

- A. Insulation with Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section "Exterior Painting" and Section "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

### 3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, concealed: supply, return, and outdoor air, including lined duct.
  - 2. Above ceiling surfaces of all air devices.
- B. Items Not Insulated:
  - 1. Factory-insulated flexible ducts.
  - 2. Factory-insulated plenums and casings.
  - 3. Flexible connectors.
  - 4. Vibration-control devices.
  - 5. Factory-insulated access panels and doors.
  - 6. Transfer ducts.
  - 7. Exhaust duct serving toilets, janitor's closets, and electrical rooms.
  - 8. Exposed in occupied spaces: double wall spiral duct.
  - 9. Exposed in occupied spaces: lined duct.

### 3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. All indoor insulation shall have a minimum R-value = 6.0.
- B. Concealed, round supply-air duct, outdoor air duct and return air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
  - 2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.
- C. Concealed, rectangular, supply-air duct, outdoor air duct and return air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.  
1 ½" thick and 0.75-lb/cu. ft. nominal density may be used for lined duct.
  - 2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.

- D. Concealed, supply-air plenum, return air plenum, and outdoor air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density. 1 ½" thick and 0.75-lb/cu. ft. nominal density may be used for lined duct.
  2. Seal all joints and penetrations in jacket with woven glass-fiber fabric and mastic.

**END OF SECTION**

## SECTION 23 07 19 - HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Condensate drain piping, indoors.
  - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
  - 1. Section "Duct Insulation."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

**1.6 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

**1.7 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

**PART 2 - PRODUCTS****2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.



## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: 60 percent by volume and 66 percent by weight.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.

## 2.6 SEALANTS

### A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
  1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    - d. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      - 3) Tee covers.
      - 4) Flange and union covers.
      - 5) End caps.
      - 6) Beveled collars.
      - 7) Valve covers.
      - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.8 SECUREMENTS

- A. Bands:
  1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel, or 0.062-inch soft-annealed, galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

**3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.
  7. Flexible Connectors

### 3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### **3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION**

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.8 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section "Exterior Painting" and Section "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Condensate Drainage piping located in crawl spaces or outdoors.
  2. Underground piping.
  3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.



**3.10 INDOOR PIPING INSULATION SCHEDULE**

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 3/8 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping and Tubing:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 3/4 inch thick.

**3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE**

- A. Refrigerant Suction and Hot-Gas Piping and Tubing:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1 inch thick.

**3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Outdoor:
  - 1. Aluminum, Corrugated: 0.016 inch thick.

**END OF SECTION**



## SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
  - 1. Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

#### 1.3 DESCRIPTION:

- A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and the existing web-based operator interface and servers.
- B. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms shall be BACnet objects.

#### 1.4 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. BACnet Interoperability Building Blocks (BIBB): A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.
- D. BACnet/BACnet Standard: BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
- E. Control Systems Server: A computer(s) that maintain(s) the systems configuration and programming database.
- F. Controller: Intelligent stand-alone control device. Controller is a generic reference to building controllers, custom application controllers, and application specific controllers.

- G. Gateway: Bi-directional protocol translator connecting control systems that use different communication protocols.
- H. Local Area Network: Computer or control system communications network limited to local building or campus.
- I. Point to Point: Serial communication as defined in the BACnet standard.
- J. Primary Controlling LAN: High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
- K. Protocol Implementation Conformance Statement: A written document that identifies the particular options specified by BACnet that are implemented in a device.
- L. Router: A device that connects two or more networks at the network layer.
- M. Wiring: Raceway, fittings, wire, boxes and related items.
- N. MS/TP: Master slave/token passing. Data link protocol as defined by the BACnet standard.
- O. PC: Personal computer.
- P. PID: Proportional plus integral plus derivative.
- Q. RTD: Resistance temperature detector.

### **1.5 ACTION SUBMITTALS**

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
  - 4. Details of control panel faces, including controls, instruments, and labeling.
  - 5. Written description of sequence of operation.
  - 6. Schedule of dampers including size, leakage, and flow characteristics.

### **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and manufacturer.

### **1.7 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:
  - 1. Maintenance instructions and lists of spare parts for each type of control device.
  - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
  - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  - 5. Calibration records and list of set points.
- B. Software and Firmware Operational Documentation: Include the following:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

### **1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Manufacturer Qualifications: Engage a firm experienced in manufacturing control systems similar to those indicated for this Project and that have a record of successful in-service performance.

### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

### **1.10 PROTECTION**

- A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.
- B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

**1.11 COORDINATION**

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 26 sections relating to Fire-Alarm Systems to achieve compatibility with equipment that interfaces with that system.

**PART 2 - PRODUCTS****2.1 CONTROL SYSTEM**

- A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems. It consists of an existing high-speed, peer-to-peer network of DDC controllers, a control system server, to interface with existing web-based operator interface.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Verify that power supply is available to control units and operator workstation. Where not indicated otherwise, obtain power for control units from the nearest un-switched receptacle circuit.
- B. Verify that all field end devices and wiring are installed before proceeding with installation.
- C. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- D. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

**3.2 PROTECTION**

- A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

**3.3 COORDINATION WITH CONTROLS SPECIFIED IN OTHER SECTIONS OR DIVISIONS.**

- A. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
- B. All communication media and equipment shall be provided as specified in Communication.
- C. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the Sequences of Operation.
- D. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
- E. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
- F. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

### **3.4 INSTALLATION**

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 54 inches above the finished floor unless noted otherwise. Install wall thermostats minimum 8" away from door or window frames. Coordinate location with switches and other devices provided under other Divisions.
  - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:
  - 1. Entrances.
  - 2. Public areas.
  - 3. Where indicated.
- E. Install automatic dampers according to Section "Air Duct Accessories."
- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- G. Install labels and nameplates to identify control components according to Section "Identification for HVAC Piping and Equipment."
- H. Install duct volume-control dampers according to Section "Metal Ducts".

**3.5 ELECTRICAL WIRING AND CONNECTION INSTALLATION**

- A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification. Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.
- B. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.
- C. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.
- D. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 10 ft intervals.
- E. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
- F. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- G. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- H. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- I. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- J. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.
- K. Use color-coded conductors throughout with conductors of different colors.
- L. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

**3.6 COMMUNICATION WIRING:**

- A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.
- B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- C. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.
- D. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

**INSTRUMENTATION AND CONTROL FOR HVAC**



- E. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
- F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to manufacturer's instructions.
- G. All runs of communication wiring shall be unspliced length when that length is commercially available.
- H. All communication wiring shall be labeled to indicate origination and destination data.
- I. All communication wiring shall be labeled to indicate origination and destination data.
- J. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
- K. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:
  - 1. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 30 pF per foot.
  - 2. The maximum length of an MS/TP segment is 4000 ft with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.
  - 3. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
  - 4. An MS/TP EIA-485 network shall have no T connections.

### **3.7 GENERAL WORKMANSHIP**

- A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

### **3.8 SENSOR INSTALLATION**

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing.

- D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.
- E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
- F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m<sup>2</sup>(1 ft<sup>2</sup>) of coil area.
- G. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
- H. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

### 3.9 ACUATOR INSTALLATION

- A. General. Mount and link control damper actuators according to manufacturer's instructions.
  - 1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
  - 2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
  - 3. Provide all mounting hardware and linkages for actuator installation.
- B. Electric/Electronic
  - 1. Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer's recommendations.

### 3.10 CONTROL DAMPER INSTALLATION

- A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
- B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure ¼ in. larger than damper dimensions and shall be square, straight, and level.
- C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8 in.) of each other.
- D. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

- E. Install extended shaft or jackshaft according to manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)
- F. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.
- G. Provide a visible and accessible indication of damper position on the drive shaft end.
- H. Support ductwork in area of damper when required to prevent sagging due to damper weight.
- I. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

### 3.11 WARNING LABELS

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the control system.
  - 1. Labels shall use white lettering (12-point type or larger) on a red background.
  - 2. Warning labels shall read as follows: "C A U T I O N - This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing."
- B. Permanent warning labels shall be affixed to all motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
  - 1. Labels shall use white lettering (12-point type or larger) on a red background.
  - 2. Warning labels shall read as follows: "C A U T I O N - This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing."

### 3.12 HARDWARE AND WIRING IDENTIFICATION

- A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.
- E. Identify room sensors related to terminal boxes or valves with nameplates.
- F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
- G. Identifiers shall match record documents.

**3.13 CONTROLLERS**

- A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
- B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed on the drawings.

**3.14 PROGRAMMING**

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging.
- B. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.
- C. Software Programming: Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Embed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
  - 1. Text-based:
    - a. Must provide actions for all possible situations
    - b. Must be modular and structured
    - c. Must be commented
  - 2. Graphic-based:
    - a. Must provide actions for all possible situations
    - b. Must be documented
  - 3. Parameter-based:
    - a. Must provide actions for all possible situations
    - b. Must be documented.
- D. Operator Interface.
  - 1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points Lists on the drawings.

2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

### 3.15 CONTROLS COMMUNICATION PROTOCOL

- A. General. The electronic controls packaged with this equipment shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.
- B. Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions if the network connection is lost.
- C. I/O Capacity. The controller shall contain sufficient I/O capacity to control the target system.
- D. The Controller shall have a physical connection for a laptop computer or a portable operator's tool.
- E. Environment. The hardware shall be suitable for the anticipated ambient conditions.
  1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 40°C to 60°C (40°F to 140°F).
  2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.
- G. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 30 days.
- H. Power. Controller shall be able to operate at 90% to 110% of nominal voltage rating.
- I. Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

### 3.16 DUCT SMOKE DETECTION

- A. This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.
- B. Interlock smoke detectors to air handlers for shutdown as specified in specification section "sequence of operation".

**3.17 HARDWARE AND WIRING IDENTIFICATION**

- A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.
- E. Identify room sensors related to terminal boxes or valves with nameplates.
- F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
- G. Identifiers shall match record documents.

**3.18 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances.
- C. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.
- D. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.
- E. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 5. Test each system for compliance with sequence of operation.
  - 6. Test software and hardware interlocks.
- F. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check instrument tubing for proper fittings, slope, material, and support.
  - 5. Check installation of air supply for each instrument.

6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  8. Check temperature instruments and material and length of sensing elements.
  9. Check control valves. Verify that they are in correct direction.
  10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
  11. Check DDC system as follows:
    - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    - c. Verify that spare I/O capacity has been provided.
    - d. Verify that DDC controllers are protected from power supply surges.
- G. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### **3.19 SITE COORDINATION**

- A. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
- B. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

### **3.20 TESTING AND BALANCING**

- A. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
- B. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
- C. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
- D. The tools used during the test and balance process will be returned at the completion of the testing and balancing phase.

### **3.21 CLEANING**

- A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

- B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
- C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

### **3.22 CONTROL SYSTEM CHECKOUT AND TESTING**

- A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.
  - 1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
  - 2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
  - 3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.
  - 4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
  - 5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
  - 6. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.
  - 7. Alarms and Interlocks:
    - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
    - b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
    - c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

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### 3.24 DEMONSTRATION AND ACCEPTANCE

#### A. Demonstration:

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.
5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
6. Demonstrate compliance with Part 1, "System Performance."
7. Demonstrate compliance with sequences of operation through all modes of operation.
8. Demonstrate complete operation of operator interface.
9. Additionally, the following items shall be demonstrated:
  - a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator

position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

- b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.
- c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
- d. Interface to the building fire alarm system.
- e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
- f. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance:

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved.

### 3.25 START UP AND CHECKOUT PROCEDURES

- A. Start up, check out, and test all hardware and software and verify communication between all components.
1. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
  2. Verify that all analog and binary input/output points read properly.
  3. Verify alarms and interlocks.

### 3.26 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.
- B. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- C. Provide training on data display, alarm and status descriptors, requesting data, execution of commands, and request of logs. Include a minimum of 8 hours dedicated instructor time on-site.

- D. Schedule training with Owner with at least 7 days' notice.
- E. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.
- F. Training shall enable students to accomplish the following objectives.
  - 1. Day-to-day Operators:
    - a. Proficiently operate the system
    - b. Understand control system architecture and configuration
    - c. Understand DDC system components
    - d. Understand system operation, including DDC system control and optimizing routines (algorithms)
    - e. Operate the workstation and peripherals
    - f. Log on and off the system
    - g. Access graphics, point reports, and logs
    - h. Adjust and change system set points, time schedules, and holiday schedules
    - i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
    - j. Understand system drawings and Operation and Maintenance manual
    - k. Understand the job layout and location of control components
    - l. Access data from DDC controllers and ASCs
    - m. Operate portable operator's terminals
- G. Advanced Operators:
  - a. Make and change graphics on the workstation
  - b. Create, delete, and modify alarms, including annunciation and routing of these
  - c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals
  - d. Create, delete, and modify reports
  - e. Add, remove, and modify system's physical points
  - f. Create, modify, and delete programming
  - g. Add panels when required
  - h. Add operator interface stations
  - i. Create, delete, and modify system displays, both graphical and others
  - j. Perform DDC system field checkout procedures
  - k. Perform DDC controller unit operation and maintenance procedures
  - l. Perform workstation and peripheral operation and maintenance procedures
  - m. Perform DDC system diagnostic procedures
  - n. Configure hardware including PC boards, switches, communication, and I/O points
  - o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
  - p. Adjust, calibrate, and replace system components
- H. System Managers/Administrators:
  - a. Maintain software and prepare backups
  - b. Interface with job-specific, third-party operator software
  - c. Add new users and understand password security procedures

- I. Organize the training into sessions or modules for the three levels of operators listed above. (Day-to-Day Operators, Advanced Operators, System Managers and Administrators). Students will receive one or more of the training packages, depending on knowledge level required.
- J. Classroom training shall be done using a network of working controllers representative of installed hardware.

**END OF SECTION**

## **SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

#### **1.3 DEFINITIONS**

- A. DDC: Direct digital control.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract.
- B. Shop Drawings showing operating sequences of various equipment, devices, components, and materials included in the Text and defining the components' contribution to the system.

#### **1.5 SMOKE DETECTORS AND SMOKE DAMPERS**

- A. In systems with air handling capacity above 2,000 CFM and up to and including 15,000 CFM and all units serving egress corridors, the smoke detector mounted in the unit or main supply ductwork shall, when sensing smoke, shut down the Air Handling Unit. The smoke detectors shall be connected to the fire alarm system. The actuation of smoke detector shall activate a visible and supervisory signal at a constantly attended location. Where an outdoor condensing unit or heat pump is used it shall shut down those components.
- B. Smoke (or Combination) Damper/Smoke Detector: Upon sensing smoke at the detector, the damper shall close. When the damper is closed, the indicator light shall illuminate on the ceiling below the damper.

**1.6 ENERGY CONSERVATION**

- A. Dead Band: Where used to control both heating and cooling, zone thermostats shall be capable of providing a temperature dead band of at least 5°F in accordance with ASHRAE standard 90.1.
- B. All HVAC systems/units shall be scheduled for operation by the DDC system. Coordinate the occupancy schedules with the Owner.
- C. In unoccupied mode, the temperature set point shall be set back to 50°F (adjustable) for heating 85°F (adjustable) and 60% relative humidity (adjustable) for cooling. Units shall run only as required to maintain setback temperatures and humidity. Outside air dampers shall be closed during unoccupied mode where motorized dampers are indicated on the plans unless required for positive pressurization defined in other paragraphs of this section.
- D. HVAC systems shall energize to cool or warm the spaces to normal occupied setpoint in morning warm up/ cool down mode. Outside air dampers shall NOT be open during warm-up/cool-down mode where motorized dampers are indicated on the plans.
- E. Outside air dampers shall only be open when the building is in occupied mode where motorized dampers are indicated on the plans.
- F. Individual HVAC units shall be equipped with override features on unit thermostats. When the button is activated, the unit shall operate in occupied mode for a period determined by the Owner.

**1.7 SAFETY SYSTEMS**

- A. All Air-handling units shall deenergize on any general building fire alarm activation.

**1.8 RELIABILITY AND GENERAL ALARM SYSTEMS**

- A. Auto Restart: All HVAC systems and equipment shall be configured such that normal operation is resumed after a power failure.

**1.9 Split System Heat Pumps:**

- A. Units shall be controlled by the existing DDC thermostat.
- B. Occupied Mode: The supply fan shall run continuously during Occupied Mode and maintain 74°F (adj.) space cooling setpoint and 70°F (adj.) space heating setpoint.
- C. Unoccupied Mode (night setback): The supply fan shall run intermittently and maintain 85°F (adj.) space cooling setpoint and 55°F (adj.) space heating setpoint.
- D. High Zone Temp Alarm: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).

- E. Low Zone Temp Alarm: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
- F. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
- G. Zone Optimal Start: The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
- H. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- I. Supply Air Smoke Detection: The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.
- J. Alarms shall be provided as follows:
  - 1. Supply Fan Failure: Commanded on, but the status is off.
  - 2. Supply Fan in Hand: Commanded off, but the status is on.
  - 3. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
- K. Cooling Stages: The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. Cooling shall be enabled whenever outside air temperature is greater than 45°F (adj.) and the economizer (if present) is disabled or fully open and the zone temperature is above cooling setpoint and the supply fan status is on and the heating is not active.
- L. Heating Stages: The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. Heating shall be enabled whenever outside air temperature is less than 65°F (adj.) and the zone temperature is below heating setpoint and the supply fan status is on and the cooling is not active.
- M. Supply Air Temperature: The controller shall monitor the supply air temperature. Alarms shall be provided for High Supply Air Temp (If the supply air temperature is greater than 125°F (adj.)) and Low Supply Air Temp (If the supply air temperature is less than 35°F (adj.)).

#### **1.10 PACKAGED ROOFTOP UNITS**

- A. Units shall be controlled by the existing DDC thermostat.

- B. Runtime of the unit shall be scheduled by the FMS. Each unit shall be individually scheduled.
- C. Occupied Mode: The supply fan shall run continuously during Occupied Mode and maintain 74°F (adj.) space cooling setpoint and 70°F (adj.) space heating setpoint.
- D. Unoccupied Mode (night setback): The supply fan shall run intermittently and maintain 85°F (adj.) space cooling setpoint and 55°F (adj.) space heating setpoint.
- E. High Zone Temp Alarm: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- F. Low Zone Temp Alarm: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
- G. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
- H. Zone Optimal Start: The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
- I. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- J. Supply Air Smoke Detection: The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.
- K. Alarms shall be provided as follows:
  - 1. Supply Fan Failure: Commanded on, but the status is off.
  - 2. Supply Fan in Hand: Commanded off, but the status is on.
  - 3. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
- L. Cooling Stages: The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. Cooling shall be enabled whenever outside air temperature is greater than 45°F (adj.) and the economizer (if present) is disabled or fully open and the zone temperature is above cooling setpoint and the supply fan status is on and the heating is not active.
- M. Economizer (where specified): The controller shall measure the zone temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F less than the zone cooling setpoint. The economizer shall be enabled whenever outside air temperature is less than 55°F (adj.) and the outside air temperature is less than the return air temperature and the supply fan status is on. The economizer shall



close whenever mixed air temperature drops from 45°F to 40°F (adj.) or on loss of supply fan status.

- N. Dehumidification (where specified): The controller shall measure the space humidity and control the HGRH output to maintain space humidity at or below 60% rh (adj.). Dehumidification shall be enabled whenever the supply fan status is on and a call for dehumidification exists.
- O. Mixed Air Temperature: The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present). Alarms shall be provided for High Mixed Air Temp (If the mixed air temperature is greater than 110°F (adj.)) and Low Mixed Air Temp (If the mixed air temperature is less than 40°F (adj.)).
- P. Supply Air Temperature: The controller shall monitor the supply air temperature. Alarms shall be provided for High Supply Air Temp (If the supply air temperature is greater than 125°F (adj.)) and Low Supply Air Temp (If the supply air temperature is less than 35°F (adj.)).
- Q. Where systems are designated to utilize CO2 based ventilation controls, outdoor damper shall modulate from the minimum position to the maximum position when the room air CO2 level exceeds 900 ppm.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION (Not Applicable)**

**END OF SECTION**



## SECTION 23 21 13 - CONDENSATE PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
  - 1. Condensate-drain piping.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed. Stored piping shall be elevated above grade. Stored piping shall not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from dirt, debris, and moisture.
- D. Protect stored plastic piping from direct sunlight. Support to prevent sagging and bending.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of piping with equipment and with other installations.
- B. Coordinate pipe sleeve installation for foundation wall penetrations.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

- D. Coordinate pipe fitting pressure classes with products specified in related Sections.
- E. Coordinate installation of pipe sleeves for penetrations in exterior walls and floor assemblies.
- F. Coordinate with requirements for firestopping for fire and smoke wall and floor assemblies.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Condensate drain piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
  - 1. Condensate-Drain Piping: 150 deg F.

### **2.2 COPPER TUBE AND FITTINGS**

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L .
- B. Copper or Bronze Pressure-Seal Fittings:
  - 1. Housing: Copper.
  - 2. O-Rings and Pipe Stops: EPDM.
  - 3. Tools: Manufacturer's special tools.
  - 4. Minimum 200-psig working-pressure rating at 250 deg F.
- C. Wrought-Copper Unions: ASME B16.22.

### **2.3 JOINING MATERIALS**

- A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

### **2.4 TRANSITION FITTINGS**

- A. Plastic-to-Metal Transition Fittings:
  - 1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.
- B. Plastic-to-Metal Transition Unions:
  - 1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

## **CONDENSATE DRAIN PIPING**

## 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 125 psig minimum at 180 deg F.
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Condensate-Drain Piping: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

### 3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations are approved by the engineer..
- B. Install piping tight to slabs, beams, joists, columns, walls, and other building elements unless noted otherwise.

- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- M. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

### **3.3 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

### **CONDENSATE DRAIN PIPING**

- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.

### 3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  - 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Braze Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

### **3.6 TERMINAL EQUIPMENT CONNECTIONS**

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

### **3.7 CLEANING**

- A. Before installation of copper tubing, clean tubing and fittings with trichloroethylene.

**END OF SECTION**



## SECTION 23 23 00 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
  - 2. Suction Lines for Heat-Pump Applications: 535 psig.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

**1.8 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed. Stored piping shall be elevated above grade. Stored piping shall not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from dirt, debris, and moisture.

**1.9 COORDINATION**

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

**PART 2 - PRODUCTS****2.1 COPPER TUBE AND FITTINGS**

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  - 4. Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

**2.2 REFRIGERANTS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Atofina Chemicals, Inc.
  - 2. DuPont Company; Fluorochemicals Div.
  - 3. Honeywell, Inc.; Genetron Refrigerants.

**REFRIGERANT PIPING**

4. INEOS Fluor Americas LLC.
- C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

### **PART 3 - EXECUTION**

#### **3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A**

- A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

#### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved by the engineer.
- B. Verify final equipment locations before roughing in piping.
- C. Install piping tight to slabs, beams, joists, columns, walls, and other building elements unless noted otherwise.
- D. Install refrigerant piping according to ASHRAE 15.
- E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- H. Install piping adjacent to machines to allow service and maintenance.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Refer to Section "Instrumentation and Control for HVAC" and Section "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- M. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

- N. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- O. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- P. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- Q. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Identify refrigerant piping and valves according to Section "Identification for HVAC Piping and Equipment."
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

### 3.3 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BA<sub>g</sub>, cadmium-free silver alloy for joining copper with bronze or steel.
- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

## REFRIGERANT PIPING

- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

**3.6 SYSTEM CHARGING**

- A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
  2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  4. Charge system with a new filter-dryer core in charging line.

**3.7 ADJUSTING**

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Open shutoff valves in condenser water circuit.
  2. Verify that compressor oil level is correct.
  3. Open compressor suction and discharge valves.
  4. Open refrigerant valves except bypass valves that are used for other purposes.
  5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

**END OF SECTION**

## SECTION 23 31 13 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Duct liner.
  - 5. Sealants and gaskets.
  - 6. Hangers and supports.
- B. Related Sections:
  - 1. Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.3 DEFINITIONS

- A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this section, the following definitions apply:
- B. Longitudinal Seams: Joints oriented in the direction of airflow.
- C. Transverse joints: Connections of the two duct sections oriented perpendicular to airflow.
- D. Duct wall penetrations: Openings made by any screw, fastener, pipe, rod or wire.
- E. SMACNA Seal Classes are defined as follows:
  - 1. A - All transverse joints, longitudinal seams, and duct wall penetrations.
  - 2. B – All transverse joints and longitudinal seams.
  - 3. C – Transverse joints only.
- F. Conditioned Spaces: a cooled space, heated space, or indirectly conditioned space. An indirectly conditioned space includes return air plenums.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of the following products:
1. Liners and adhesives.
  2. Sealants and gaskets.

**1.6 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
  2. Suspended ceiling components.
  3. Structural members to which duct will be attached.
  4. Size and location of initial access modules for acoustical tile.
  5. Penetrations of smoke barriers and fire-rated construction.
  6. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Perimeter moldings.
- B. Welding certificates.

**1.7 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilation Systems"

**METAL DUCTS**



## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle sealant materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 or G90 for use in concealed, interior ductwork, G90 for all exterior and exposed ductwork.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### METAL DUCTS

## 2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
  2. Solvent or Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Surface shall be smooth and coated to prevent erosion of glass fibers into air stream.
  4. Sound Absorption Coefficient NRC shall be no less than 0.70 for 1" thick.
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
  7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
  8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    - a. Fan discharges.

- b. Intervals of lined duct preceding unlined duct.
  - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
- a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Water resistant.
  4. Mold and mildew resistant.
  5. VOC: Maximum 75 g/L (less water).
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor or outdoor.
  8. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
- C. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Base: Synthetic rubber resin.
  3. Solvent: Toluene and heptane.
  4. Solids Content: Minimum 60 percent.
  5. Water resistant.
  6. Mold and mildew resistant.
  7. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  8. VOC: Maximum 395 g/L.
  9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
  10. Service: Indoor or outdoor.
  11. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.

## METAL DUCTS

2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
  6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction

loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### **3.2 INSTALLATION OF EXPOSED DUCTWORK**

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

## **METAL DUCTS**

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article below, and according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Solvent based sealant shall only be used in applications where freezing may occur before sealant is cured. Water based sealant shall be used in all other applications.
- C. Prepare duct surface in accordance with duct sealant manufacturer's printed instructions.
- D. Seal externally insulated ducts prior to installation of insulation.
- E. All duct sealing shall be in accordance with ASHRAE standard 90.1.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

**3.6 PAINTING**

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section "Exterior Painting" and Section "Interior Painting."

**3.7 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Inspections and Leakage Tests:
  - 1. All ductwork shall be approved by Architect prior to the application of external insulation. Smoke testing, pressure testing, or other leakage testing will be required if inspection is not performed.

**3.8 CLEANING**

- A. Vacuum ducts prior to final acceptance to remove construction dust and debris.

**3.9 START UP**

- A. Air Balance: Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC."

**3.10 DUCT SCHEDULE**

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive 2-inch wg.
    - b. Minimum SMACNA Seal Class: A for ducts located outdoors, B for ducts located in unconditioned spaces, and C for ducts located in conditioned spaces.
    - c. Round runouts to supply diffusers may be "snap-lock" duct meeting the pressure classification.
  - 2. Ducts Connected to Constant-Volume Air-Handling Units:
    - a. Pressure Class: Positive 4-inch wg.
    - b. Minimum SMACNA Seal Class: A for ducts located outdoors and in unconditioned spaces, B for ducts located in conditioned spaces.
    - c. SMACNA Leakage Class for Rectangular: 6.
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- C. Return Ducts:
  - 1. All Return Ducts:

**METAL DUCTS**



- a. Pressure Class: negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: A for ducts located outdoors, B for ducts located in unconditioned spaces and C for ducts located in conditioned spaces.
- D. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: C for ducts located outdoors and in unconditioned spaces, and B for ducts located in conditioned spaces.
  2. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: C for ducts located outdoors and in unconditioned spaces, and B for ducts located in conditioned spaces.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive or negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: C.
  2. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
- F. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
  2. Stainless-Steel Ducts: Match duct material.
  3. Aluminum Ducts: Aluminum.
- G. Liner:
1. Supply, Return, and Exhaust Air Ducts: Fibrous glass, 1 inch thick.
  2. Supply Fan Plenums: Fibrous glass, 1 inch thick.
  3. Return- and Exhaust-Fan Plenums: Fibrous glass, 2 inches thick.
  4. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
- H. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.

- b. Velocity 1000 to 1500 fpm:
    - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
    - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
    - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - c. Velocity 1500 fpm or Higher:
    - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
- a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
- a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
    - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
    - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
    - 4) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or welded.
- I. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
- a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Adjustable takeoff fitting.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.

**END OF SECTION**



## **SECTION 23 74 13 - PACKAGED ROOFTOP UNITS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes packaged, outdoor, rooftop units with the following components and accessories:
  - 1. Direct-expansion cooling.

#### **1.3 DEFINITIONS**

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- D. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- E. Evaporator Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members to which RTUs will be attached.
  - 2. Roof openings
- B. Warranty: Special warranty specified in this Section.

**1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.
- B. Manufacturer's startup worksheets for each unit on project.

**1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fan Belts: One set for each belt-driven fan.
  - 2. Filters: 3 sets of filters for each unit.

**1.8 QUALITY ASSURANCE**

- A. ARI Compliance:
  - 1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.
  - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
  - 1. Comply with ASHRAE 15 for refrigeration system safety.
  - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
  - 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- E. UL Compliance: Comply with UL 1995.

- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver units as factory-assembled units with protective crating and covering.
- B. Coordinate delivery of units in sufficient time to allow movement into building.
- C. Handle units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

### **1.10 COORDINATION**

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations with roof construction.

### **1.11 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
  - 2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AAON, Inc.
  - 2. Addison Products Company.
  - 3. Carrier Corporation.
  - 4. Johnson Controls
  - 5. Rheem Manufacturing Co.
  - 6. Tempmaster
  - 7. Trane Company (The);

### **2.2 ROOFTOP UNITS UNDER 3 TONS**

- A. CASING

PACKAGED, OUTDOOR, ROOFTOP UNITS

1. General Fabrication Requirements for Casings: Cabinets are constructed of heavy duty, phosphated, zinc--coated pre painted steel capable of withstanding 500 hours in salt spray. Roof panels to be pitched. Furnish knockouts for utility and control connections and lifting lugs. Furnish hinged access panels for inspection and access to controls section, indoor coil, and fan. Access door to filter section to be hinged. Indoor air section to be completely insulated.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

#### B. FANS

1. Direct-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
2. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
3. Fan Motor: Multi--speed ECM Blower Motor. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."

#### C. COILS

1. Evaporator Coil: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor. Condensate Drain Pan: formed with pitch and drain connections complying with ASHRAE 62.1.
2. Condenser Coil: Corrosion resistant, all aluminum construction.
3. Electric-Resistance Heating where specified: Heating Elements with heat limiters for thermal protection, automatic reset limit switches, factory wired, UL listed and single power entry kit.

#### D. REFRIGERANT CIRCUIT COMPONENTS

1. Compressor shall be fully hermetically sealed against contamination and shall have vibration isolation. All compressors have internal high pressure, overcurrent protection, high-temperature protection, internal pressure relief, and crankcase heater.
2. Refrigeration Specialties:
  - a. Refrigerant: R-410A.
  - b. Expansion valve with replaceable thermostatic element.
  - c. Refrigerant filter/dryer.
  - d. Manual-reset high-pressure safety switch.
  - e. Automatic-reset low-pressure safety switch.
  - f. Minimum off-time relay.
  - g. Automatic-reset compressor motor thermal overload.
  - h. Brass service valves installed in compressor suction and liquid lines.
  - i. Low-ambient kit high-pressure sensor.

#### E. AIR FILTRATION



1. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
  - a. Pleated Media: Minimum 30 percent arrestance, and MERV 8.
  - b. 1" Filter Rack

F. OUTDOOR AIR

1. Outdoor-Air Damper: Manual Outdoor Air Damper Kit to consist of damper, birdscreen, and rainhood.

G. CONTROLS

1. Existing DDC Controllers shall be reused.

H. ACCESSORIES

1. Coil guards of painted, galvanized-steel wire.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Equipment Mounting:
  1. Comply with requirements for vibration isolation devices specified in Section "Vibration Controls for HVAC."
- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

- C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- D. Install units according to manufacturer's written instructions.

### 3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain, area drain, or gutter. Condensate piping to be Type L copper with soldered fittings.
- B. Install piping adjacent to RTUs to allow service and maintenance.
- C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination at top of roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section "Air Duct Accessories."
  - 4. Install return-air duct continuously through roof structure.
  - 5. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified with concrete.
- D. Electrical: Conform to applicable requirements in Division 26 Sections.
- E. Ground equipment. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
  - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

### **3.5 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
  1. Inspect for visible damage to unit casing.
  2. Inspect for visible damage to compressor, coils, and fans.
  3. Inspect internal insulation.
  4. Verify that labels are clearly visible.
  5. Verify that clearances have been provided for servicing.
  6. Verify that controls are connected and operable.
  7. Verify that filters are installed.
  8. Clean condenser coil and inspect for construction debris.
  9. Remove packing from vibration isolators.
  10. Inspect operation of barometric relief dampers.
  11. Verify lubrication on fan and motor bearings.
  12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  13. Adjust fan belts to proper alignment and tension.
  14. Start unit according to manufacturer's written instructions.
    - a. Start refrigeration system.
    - b. Do not operate below recommended low-ambient temperature.
    - c. Complete startup sheets and attach copy with Contractor's startup report.
  15. Inspect and record performance of interlocks and protective devices; verify sequences.
  16. Operate unit for an initial period as recommended or required by manufacturer.
  17. Calibrate thermostats.
  18. Adjust and inspect high-temperature limits.
  19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
  20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
    - a. Coil leaving-air, dry- and wet-bulb temperatures.
    - b. Coil entering-air, dry- and wet-bulb temperatures.
    - c. Outdoor-air, dry-bulb temperature.
    - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Return-air volume.
  - c. Relief-air volume.
  - d. Outdoor-air intake volume.
23. Simulate maximum cooling demand and inspect the following:
  - a. Compressor refrigerant suction and hot-gas pressures.
  - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
24. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

### **3.6 CLEANING AND ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two Insert number visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

### **3.7 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section "Demonstration and Training."

**END OF SECTION**

## **SECTION 23 81 26 - SPLIT-SYSTEM HEAT PUMPS AND AIR-CONDITIONERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For split-system air-conditioning and heat pump units to include in emergency, operation, and maintenance manuals.
- B. Manufacturer's startup worksheets for each unit on project.

#### **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Three set(s) for each air-handling unit.
2. Fan Belts: One set(s) for each air-handling unit fan.

### 1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
  1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- D. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.

### 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.
- B. The unit controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

### 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  1. Warranty Period:
    - a. For Compressor: Five year(s) from date of Substantial Completion.
    - b. For Parts: One year(s) from date of Substantial Completion.
    - c. For Labor: One year(s) from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Daikin
  2. Carrier Corporation.
  3. Friedrich Air Conditioning Company.
  4. Lennox International Inc.
  5. LG Electronics, HVAC Division
  6. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
  7. McQuay International.
  8. SANYO North America Corporation; SANYO Fisher Company.
  9. Trane; a brand of Ingersoll Rand.

### **2.2 INDOOR UNITS (5 TONS OR LESS)**

- A. Concealed Evaporator-Fan Components:
1. Chassis: Galvanized steel with baked enamel finish and flanged edges, removable panels for servicing, and insulation on back of panel.
  2. Insulation: Faced, glass-fiber duct liner.
  3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110. Furnished with expansion device, check valve and defrost thermostat accessory.
  4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection. Heater shall be designed specifically for the indoor unit and shall meet all requirements of the National Electric Code and Underwriters Laboratories and shall be so stamped.
  5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
  6. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section "Common Motor Requirements for HVAC Equipment."
    - b. Multitapped, multispeed (minimum 3 speed) with internal thermal protection and permanent lubrication.
    - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
  7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  8. Filters: 1-inch thick minimum, disposable, framed with filter rack.
  9. Condensate Drain Pans:
    - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

- 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
  - 2) Depth: A minimum of 2 inches deep.
- b. Single-wall, galvanized-steel sheet.
  - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
  - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

### 2.3 OUTDOOR UNITS (5 TONS OR LESS)

#### A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Heavy gauge galvanized steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
  - a. Compressor Type: Scroll.
  - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
  - c. Refrigerant Charge: R-410A.
  - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient: Permits cooling operation down to 0 deg F.
7. Mounting Base: Polyethylene.
8. Furnish the following accessories: condenser coil guard, 5 minute anti recycle timer, hard start kit for units with single phase power, defrost for indoor coil, and outdoor air thermostat to prevent resistant heat from energized above 45 deg F (adjustable).

### 2.4 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section "Instrumentation and Control for HVAC" and Section "Sequence and Operations for HVAC Controls."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install unit's level and plumb.

## SPLIT-SYSTEM AIR-CONDITIONERS



- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:
  - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s).

### **3.2 CONNECTIONS**

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
  - 1. Piping Connections: Comply with piping requirements specified in other sections.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section "Air Duct Accessories."
- D. Electrical: Comply with all applicable sections regarding electrical and grounding requirements.

### **3.3 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

### **3.4 STARTUP SERVICE**

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Furnish startup worksheet with close out documents.
- B. Perform the following commissioning for all units:
  - 1. Level unit on support structure.
  - 2. Inspect for visible damage to unit casing.

3. Inspect for visible damage to compressor, air-cooled condenser coil, and fans.
4. Verify that clearances have been provided for servicing.
5. Check that labels are clearly visible.
6. Verify that controls are connected and operable.
7. Remove shipping bolts, blocks, and tie-down straps.
8. Verify that filters are installed.
9. Adjust vibration isolators.
10. Check acoustic insulation.
11. Lubricate bearings on fan.
12. Check fan-wheel rotation for correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.
15. Perform starting of refrigeration in summer only.
16. Complete startup sheets and attach copy with Contractor's startup report.
17. Check and record performance of interlocks and protection devices; verify sequences.
18. Operate unit for an initial period as recommended or required by manufacturer.
19. Calibrate thermostats.
20. Check internal isolators.
21. Check controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.
22. Simulate maximum cooling demand and check the following:
23. Compressor refrigerant suction and hot-gas pressures.
24. Short circuiting air through condenser or from condenser to outside-air intake.
25. After starting and performance testing, install clean filters, vacuum heat exchanger and cooling and condenser coils, lubricate bearings and adjust belt tension.

### 3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.
  1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
  2. Review data in the maintenance manuals.
  3. Schedule training with Owner, through Architect, with at least 7 days' advance

**END OF SECTION**