

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

1.2 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 store.
- 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.

1.3 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.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

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

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.8 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.
 - 1. Before selective demolition, Owner will remove items that may interfere with demolition activities.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Based on hazmat report provided by the Owner. It is not expected that hazardous materials will be encountered in the Work.
 - 1. 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. 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.

1.9 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 ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 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.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.3 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

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- 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 fire watch during and for at least 24 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal", and Green Globes Requirements.

- 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.

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.] [and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal", and Green Globes requirements.
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.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

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.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.6 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 024119

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 064023 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories, including steel countertop supports as shown on drawings.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 123661.16 "Solid Surfacing Countertops" for countertops.

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.

B. Product Data Submittals: For each product.

C. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

D. Samples for Initial Selection: For each type of exposed finish.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

E. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
 - a. Provide one sample applied to core material with specified edge material applied to one edge.
2. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches, for each color, pattern, and surface finish.
 - a. Provide edge banding on one edge.
3. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Certificates: For each type of product.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Manufacturer of products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 degrees and 90 degrees F and relative humidity between 43 and 70 percent during the remainder of the construction period.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
- B. Architectural Woodwork Standards:
 - 1. Aesthetics Grade: Custom.
 - 2. Performance Duty: Duty Level 4.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Reveal overlay.
 - 1. Reveal Dimension: 1/2 inch.
- E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.
 - 1. Basis-of-Design Manufacturer: Wilsonart LLC or comparable products by one of the following:
 - a. Formica Corporation.
 - b. Laminart LLC.
 - c. Pionite; a Panolam Industries International, Inc. brand.
- F. Exposed Surfaces:
 - 1. Plastic-Laminate Grade: HGS.
 - 2. Edges: PVC T-mold matching laminate in color, pattern, and finish PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
 - 3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

G. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels.
 - a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
 - b. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.
 - c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.
2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints to meet performance duty.

J. Colors, Patterns, and Finishes: See "Interior Material Schedule" Sheet A700.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Thermally Fused Laminate (TFL) Panels: MDF finished with thermally fused, melamine-impregnated decorative paper.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening , self-closing.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
 - 1. Wire Pulls: Back mounted, solid metal , 4 inches long, 5/16 inch in diameter.
- D. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.
- E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
- G. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.
 - a. Type: Full extension.
 - b. Material: Galvanized steel ball bearing slides.
 - c. Motion Feature: Push to open and self-closing mechanism.
 - 2. Pencil drawers not more than 3 inches high and not more than 24 inches wide, provide 50 lb. load capacity.
 - 3. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 75 lb. load capacity.
 - 4. File drawers more than 6 inches high or more than 24 inches wide, provide 100 lb. load capacity.
 - 5. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 150 lb. load capacity.
 - 6. Lateral file drawers more than 6 inches high and more than 30 inches wide, provide 200 lb. load capacity.
 - 7. Computer keyboard tray, provide 75 lb. load capacity.
- H. Door Locks: ANSI/BHMA A156.11, E07121.
 - 1. Provide locks at Kitchenette.
- I. Drawer Locks: ANSI/BHMA A156.11, E07041.
 - 1. Provide locks at Kitchenette.
- J. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- K. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Color: Black.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - 1. Satin Stainless Steel: ANSI/BHMA 630.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.
- N. Concealed Steel Countertop Supports: Basis-of-design product "Iron Supports" L-shaped bracket. www.ironsupports.com, (888) 971-3771.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
 - 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064023

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 072119 - FOAMED-IN-PLACE INSULATION

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. Open-cell spray polyurethane foam and ignition barrier, for attic spaces.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 OPEN-CELL SPRAY POLYURETHANE FOAM (ROOF)

- A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 0.4 lb/cu. ft. (6.4 kg/cu. m) and minimum aged R-value at 1-inch (25.4-mm) thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F (24 K x sq. m/W at 24 deg C).
 - 1. Basis-of-Design Product: Sealection Agribalance manufactured by Demilec (USA) LLC, or similar product by one of the following, subject to compliance with requirements:
 - a. BASF Corporation.
 - b. CertainTeed Corporation.
 - c. Covestro LLC; Polyurethanes (formerly Bayer MaterialScience).
 - d. Gaco Western LLC.
 - e. Henry Company.
 - f. Icynene Inc.
 - g. Johns Manville; a Berkshire Hathaway company.
 - 2. Prescriptive Ignition Barrier: Provide manufacturer compliant ignition barrier, compliant with ICC-ED certification.
 - 3. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 5. Minimum Total R-Value = 22

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions.
- F. Install ignition barrier per manufacturer's written instructions.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetration firestopping systems for the following applications:

- a. Penetrations in fire-resistance-rated walls.

- B. Related Requirements:

- 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and UL design designation.

- 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

- 1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. Hilti, Inc.
 - c. Specified Technologies, Inc.
 - d. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- H. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

END OF SECTION 078413

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 079200 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sealants.
 - 2. Joint backing.
- B. Related Requirements:
 - 1. Section 079219 "Acoustical Joint Sealants" for joint sealants in acoustical applications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product including:
 - 1. Preparation instructions and recommendations.
 - 2. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.
 - 3. Data for sealants required in each fire resistance rated assembly.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint sealant application, joint location, and designation.
 - 2. Joint sealant manufacturer and product name.
 - 3. Joint sealant formulation.
 - 4. Joint sealant color.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit qualification data for qualified applicator.
- B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- C. Warranty: Sample of unexecuted manufacturer and installer special warranties.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- D. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide exterior joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.
- B. Installer Qualifications: Company with minimum of three years experience specializing in work of this section, employing applicators trained for application of joint sealants required for this project, with record of successful completion of projects of similar scope, and approved by manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Accept materials on site in manufacturer's unopened original packaging.
- B. Store primers and sealants in dry location with ambient temperature range of 60 degrees to 80 degrees F

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install primers or sealants under the following conditions:
 - 1. When atmospheric temperatures or joint surface temperatures are less than 40 degrees F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 SCHEDULING

- A. Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.
- B. Ensure sealants are cured before covering with other materials.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.9 COORDINATION

- A. Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or adhesive or cohesive failure under normal use within warranty period specified.
 - 1. Urethane Sealants:
 - a. Vertical Applications: 10 years from date of Substantial Completion
 - b. Horizontal Applications: 5 years from date of Substantial Completion
 - 2. Silicone Sealants: 20 years from date of Substantial Completion
 - 3. Silicone (Mildew) Sealants: 5 years from date of Substantial Completion
- B. Installer's Warranty: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.
 - 1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco, Inc., Commercial Sealants and Waterproofing Division, An RPM Company; products or comparable products by one of the following:
 - 1. GE Construction Sealants; Momentive Performance Materials Inc.
 - 2. Pecora Corporation.
 - 3. Sika Corporation - Building Components.

2.2 MATERIALS - GENERAL

- A. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with adjacent materials, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.
- B. Joint Sealant Standard: Comply with ASTM C920 and other specified requirements for each joint sealant.
- C. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per ASTM C1248 as non-staining on porous joint substrates specified.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- D. Fire Resistance Rated Assemblies: Where sealants are required in fire resistance rated assemblies, provide sealants that have been tested in that assembly.

2.3 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, Use NT; SWRI validated.
 - 1. Basis of Design Product: Spectrem 1.
 - 2. Applications: Use for typical exterior conditions including sheet metal to metal detailing.
 - 3. Color: As selected by Architect from manufacturer's standard line.
- B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Basis of Design Product: Tremsil 200 Sanitary.
 - 2. Applications: Use for restroom.
 - 3. Color: White and clear.

2.4 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Moisture-Cure, Polyurethane Joint Sealant, ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Basis of Design Product: Dymonic 100.
 - 2. Tensile Strength (ASTM D412): 350 to 450 psi
 - 3. Percent Elongation (ASTM D412): 800 to 900 percent
 - 4. Modulus at 100 percent (ASTM D412): 75 to 85 psi
 - 5. Tear Strength (ASTM D412): 65 to 75 psi
 - 6. Smoke Development (ASTM E84): 5
 - 7. Applications: Use with waterproofing systems.
 - 8. Color: As selected by Architect from manufacturer's standard line.
- B. Immersible, Multi-Component, Pourable, Traffic-Grade Polyurethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 35, Use T, O, and I.
 - 1. Basis of Design Product: Tremco, Inc., Vulkem 445SSL.
 - 1. Tensile Strength (ASTM D412): 250 psi at 100 percent elongation.
 - 2. Tear Strength (ASTM D412): 35 pli.
 - 3. Adhesion to Concrete, After Water (ASTM C 794): 28 pli
 - 4. Hardness (ASTM C661): 40 durometer Shore A, minimum.
 - 5. Accelerated Weathering (ASTM C 93): Pass.
 - 6. Applications: Use for horizontal traffic conditions.
 - 7. Color: As selected by Architect from manufacturer's standard line.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.5 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Basis of Design Product: Tremflex 834.
 - 2. Applications: Use for typical interior applications, such as walls, floors and ceilings, and as an acoustical sealant.
 - 3. Color: White, paintable.

2.6 JOINT SEALANT ACCESSORIES

- A. Cylindrical Sealant Backing: ASTM C1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.
- B. Bond Breaker Tape: Polymer tape compatible with joint sealant and adjacent materials and recommended by sealant manufacturer.
- C. Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.
- D. Cleaners: Chemical cleaners acceptable to joint sealant manufacturer.
- E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joint profiles and surfaces to determine if work is ready to receive joint sealants.
 - 1. Verify joint dimensions are adequate for development of sealant movement capability.
 - 2. Verify joint surfaces are clean, dry, and adequately cured.
- B. Proceed with joint sealant work once conditions meet sealant manufacturer's written recommendations.

3.2 PREPARATION

- A. Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer. Comply with ASTM C1193.
 - 1. Remove curing compounds, laitance, form-release agents, dust, and other contaminants.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2. Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.
3. Protect elements surrounding Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.

3.3 SEALANT APPLICATION

- A. Sealant and Primer Installation Standard: Comply with ASTM C1193 and manufacturer's written instructions.
- B. Joint Backing: Select joint backing materials recommended by sealant manufacturer as compatible with sealant and adjacent materials. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.
 1. Install joint backing to maintain the following joint ratios:
 - a. Joints up to 1/2 inchwide: 1:1 width to depth ratio.
 - b. Joints greater than 1/2 inchwide: 2:1 width to depth ratio; maximum 1/2-inch joint depth.
 2. Install bond breaker tape over substrates when sealant backings are not used.
- C. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.
- D. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.
- E. Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.
 1. Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
 2. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
 3. Tool exposed joint surface concave using tooling agents approved by sealant manufacturer for application.
- F. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.
 1. Remove masking tape immediately after tooling joint without disturbing seal.
 2. Remove excess sealant from surfaces while still uncured.
- G. Acoustical Sealant: See Section 079219 "Acoustical Sealant Joints."

END OF SECTION 079200

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical joint sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for joint sealants in nonacoustical applications.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical joint sealants.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

C. Samples for Verification: For each type and color of acoustical joint sealant required.

1. Size: 1/2-inch- wide sealant joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Acoustical Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each type of acoustical joint sealant, for tests performed by qualified testing agency.

B. Sample warranties.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.4 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.

1.5 WARRANTY

- A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

- A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated; Tremflex 834 or comparable product by one of the following:
 - a. OSI Sealants; Henkel Corporation.
 - b. Pecora Corporation.
 - c. USG Corporation.

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel frames.
2. Interior borrowed lite (window and sidelite) frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
2. Locations of reinforcement and preparations for hardware.
3. Details of each different wall opening condition.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings and glazing.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
 - 3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door; AADG, Inc.; ASSA ABLOY.
 - 2. Curries, AADG, Inc.; ASSA ABLOY Group.
 - 3. Republic Doors and Frames; an Allegion brand.
 - 4. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

2.3 INTERIOR STANDARD STEEL FRAMES

- A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. .
 - 1. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Construction: Face welded.
 - 2. Exposed Finish: Prime.

2.4 BORROWED LITES

- A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.
- B. Construction: Face welded.
- C. Fabricate in one piece.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- C. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- D. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- E. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Provide fixed frame moldings on secure side of interior frames. Provide loose stops and moldings on inside of hollow-metal frames.
 - 3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 .
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 - 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - 4. Solidly pack mineral-fiber insulation inside frames.
 - 5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core flush wood veneer-faced doors for transparent finish.
2. Light frames.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.
2. Light frames.

B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-machining criteria.
6. Factory- finishing specifications.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Doors to be factory finished and application requirements.

D. Samples for Initial Selection: For factory-finished doors.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualifications for Manufacturer: Letter indicating licensed participant in AWI's Quality Certification Program.
- B. Qualification Data: For door inspector.
 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
 3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.
- C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Special warranties.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program
- B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.
- C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 degrees and 90 degrees F and relative humidity between 43 and 70 percent during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.3 FLUSH WOOD DOORS AND FRAMES, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

- A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lambton Doors.
 - b. Masonite Architectural.
 - c. Oshkosh Door Company.
 - d. VT Industries, Inc.
 - 2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
 - 3. ANSI/WDMA I.S. 1A Quality Grade: Custom.
 - 4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
 - a. Species: Oak.
 - b. Cut: Rift cut.
 - c. Match between Veneer Leaves: Slip match.
 - d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
 - e. Pair and Set Match: Provide for doors hung in same opening.
 - 5. Exposed Vertical and Top Edges: Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge Type B. Verify
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - 6. Core for Non-Fire-Rated Doors:
 - a. WDMA I.S. 10 structural composite lumber.
 - 1) Screw Withdrawal, Door Face: 475 lbf.
 - 2) Screw Withdrawal, Vertical Door Edge: 475 lbf.
 - 7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - 8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint or with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.6 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.7 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: Custom.
 - a. System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
 - 2. Staining: As selected by Architect from manufacturer's full range.
 - 3. Sheen: Match Architect's sample.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior aluminum-framed entrance and storefront systems.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-framed entrance and storefront systems.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.3 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront system.
- B. Product Test Reports: For aluminum-framed entrance and storefront systems, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Field Quality-Control Reports: For aluminum-framed entrance and storefront systems.
- D. Sample Warranties: For aluminum-framed entrance and storefront systems.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.

1.6 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including but not limited to excessive deflection.
 - b. Faulty operation.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering, use.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
 - c. Cracking, peeling, or chipping.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrance and storefront systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m).
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).

3. Cantilever Deflection: Limited to $2L/175$ at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (720 Pa).
 2. Maximum Water Leakage: In accordance with AAMA 501.1 and No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Seismic Performance: Aluminum-framed entrance and storefront systems to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.
- I. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.60 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.90 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2. Solar Heat-Gain Coefficient (SHGC):

- a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.
- b. Entrance Doors: SHGC of not more than 0.25 as determined in accordance with NFRC 200.

3. Air Leakage:

- a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa) when tested in accordance with ASTM E283.
- b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

4. Condensation Resistance Factor (CRF):

- a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
- b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.

J. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 34.

K. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for enhanced protection.

1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and 60 feet (18.3 m) above grade.

L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements , provide products by one of the following:

1. EFCO Corporation.
2. Kawneer Company, Inc.; Arconic Corporation.
3. OldCastle BuildingEnvelope (OBE).
4. U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.
5. YKK AP America Inc.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Exterior Framing Construction: Thermally broken.
 - 2. Interior Vestibule Framing Construction: Nonthermal.
 - 3. Glazing System: Retained mechanically with gaskets on four sides.
 - 4. Glazing Plane: Front.
 - 5. Finish: Color anodic finish.
 - 6. Fabrication Method: Field-fabricated stick system.
 - 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 8. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 - 1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - 2. Door Design: As indicated.
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 - 4. Finish: Match adjacent storefront framing finish.

2.4 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.6 MATERIALS

- A. Sheet and Plate: ASTM B209 (ASTM B209M).
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- E. Rigid PVC filler.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from exterior.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
1. Color:
 - a. Exterior: Match existing exterior storefront.
 - b. Interior: Black.

2.10 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.
- K. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- L. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- M. Install glazing as specified in Section 088000 "Glazing."

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.4 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections.
- B. Inspections:
- C. Aluminum-framed entrance and storefront systems will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
 - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

END OF SECTION 084113

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Safety glass.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 081416 "Flush Wood Doors" for vision lites.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Glazing: Glazing in rated doors and openings up to 45 minutes, limited in size, and not capable of blocking radiant heat.
- B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- C. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- D. IBC: International Building Code.
- E. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Glass Samples: For each type; 6 inches square.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturers of fabricated glass units, glass testing agency and sealant testing agency.
- B. Product Certificates: For each type of glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- E. Manufacturer's Warranty for Fire-Protection-Rated Glass:
 - 1. Warranty Period: Five years from date of purchase.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 2. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 2 for basic protection.
 - 1. Large-Missile Test: For glazing located within 30 feet of grade.
 - 2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 - 5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 - 6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.2 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

D. Sputter-Coated Low-Emissivity Clear Vision Glass:

1. Compliance: ASTM C1376, coated by sputtered process, ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated, and complying with other requirements specified.
 - a. Basis of Design: Subject to compliance with requirements, provide Vitro Architectural Glass (formerly PPG); Solarban 70 or comparable product by one of the following:
 - 1) Guardian.
 - 2) Pilkington.
2. Coating Position: Surface 2.
3. Performance Data:
 - a. Visible Light Transmission: 64 percent.
 - b. Solar Heat Gain Coefficient (SGHC): 0.27.
 - c. Outdoor Visible Light Reflectance: 13 percent.
 - d. Heat Transfer Coefficient:
 - 1) U-Value Winter: 0.28.

2.4 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 1. Construction: Laminate glass with polyvinyl butyral interlayer or ionoplast interlayers to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with the following to comply with interlayer manufacturer's written instructions:
 1. Construction: Laminate glass with polyvinyl butyral interlayer reinforced with polyethylene terephthalate film or ionoplast interlayer to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Spacers: Type recommended in writing by sealant or glass manufacturer.
- D. Edge Blocks: Type recommended in writing by sealant or glass manufacturer.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

those in referenced glazing publications.

- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- I. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Laminated Impact Glass Type:
 - 1. Overall Unit Thickness: 1-inch.
 - 2. Minimum Thickness of Outdoor Lite: 6 mm.
 - 3. Outdoor Lite: Clear heat-strengthened float glass.
 - a. Fully tempered at hazard locations as defined by the Code.
 - b. Interspace Content: Argon.
 - c. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- glass.
- d. Minimum Thickness of Each Glass Ply: 6 mm.
- e. Interlayer Thickness: 0.090 inch.
- f. Low-E Coating: Sputtered on second surface.
- g. Safety glazing required.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type: Fully tempered float glass.

- 1. Minimum Thickness: 6 mm.
- 2. Safety glazing required.

END OF SECTION 088000

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Framing systems.
 - 2. Grid suspension systems.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Framing systems.
 - 2. Grid suspension systems.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.4 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For non-composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft.
- D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 for conditions indicated.
 - 1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. Marino\WARE.
 - c. Telling Industries.
 - 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
 - 3. Depth: As indicated on Drawings.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

C. Slip-Type Head Joints: Where indicated, provide :

1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) ClarkDietrich.
 - 2) Marino\WARE.
 - 3) Telling Industries.
2. Install deflection track prior to spray fireproofing.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: As indicated on Drawings.

E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

2.3 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Ceiling & Wall Solutions.
 - b. CertainTeed; SAINT-GOBAIN.
 - c. USG Corporation.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches on center.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.4 INSTALLATION OF FRAMING SYSTEMS

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches on center unless otherwise indicated.
 - 2. Tile Backing Panels: 16 inches on center unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs at spacing indicated on Drawings.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.5 INSTALLATION OF GRID SUSPENSION SYSTEMS

- A. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.6 FIELD QUALITY CONTROL

- A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 079219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum ceiling board.
3. Mold-resistant gypsum board.
4. Interior trim.
5. Joint treatment materials.
6. Tile backing panels.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. Armstrong Ceiling & Wall Solutions.
 - c. CertainTeed; SAINT-GOBAIN.
 - d. Georgia-Pacific Gypsum LLC.
 - e. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed; SAINT-GOBAIN.
 - b. Georgia-Pacific Gypsum LLC.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - d. USG Corporation.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. Armstrong Ceiling & Wall Solutions.
 - c. CertainTeed; SAINT-GOBAIN.
 - d. Georgia-Pacific Gypsum LLC.
 - e. Gold Bond Building Products, LLC provided by National Gypsum Company.
2. Core: As indicated on Drawings.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. PermaBASE Building Products, LLC provided by National Gypsum Company.
 - c. USG Corporation.
2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Paper-faced galvanized-steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
 - 3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: See Section 072100 "Thermal Insulation."
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- F. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings Vertical surfaces unless otherwise indicated.
 - 2. Type X: As indicated on Drawings.
 - 3. Flexible Type: Apply in double layer at curved assemblies as indicated on Drawings.
 - 4. Ceiling Type: As indicated on Drawings.
 - 5. Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLATION OF TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated on Drawings.
4. U-Bead: Use where indicated on Drawings.

3.6 FINISHING OF GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Porcelain tile.
 - 2. Thresholds.
 - 3. Waterproof membranes.
 - 4. Crack isolation membranes.
 - 5. Setting material.
 - 6. Grout materials.

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Porcelain tile.
 - 2. Thresholds.
 - 3. Tile backing panels.
 - 4. Waterproof membranes.
 - 5. Crack isolation membranes.
 - 6. Setting material.
 - 7. Grout materials.
- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces. Show thresholds.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 24 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal flooring transitions 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, including product use classification.

D. Product Test Reports:

1. Tile-setting and -grouting products.
2. Certified porcelain tile.
3. Slip-resistance test reports from qualified independent testing agency.

E. Field Quality-Control Reports: Water test reports of membrane in wet areas.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Supervisor Certification.
3. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in "Referenced Standards" Article in the Evaluations and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Tile: Obtain\ from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Americas.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - 2. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
 - 3. Obtain underlayment from manufacturer of setting and grouting materials.
 - 4. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
 - 5. Obtain joint sealants from manufacturer of setting and grouting materials.
- C. Accessory Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Stone thresholds.
 - 2. Backer units.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard Grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 PORCELAIN TILE PRODUCTS

- A. Porcelain Tile Type:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crossville, Inc.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: 11-13/16 by 11-13/16 inches (300 by 300 mm)
 - 4. Face Size Variation: Rectified.
 - 5. Thickness: 3/8 inch (9.5 mm).
 - 6. Face: Plain with square or cushion edges.
 - 7. Dynamic Coefficient of Friction: Not less than 0.42.
 - 8. Tile Color, Glaze, and Pattern: Argent "Concrete Jungle" unpolished.
 - 9. Grout Color: As selected by Architect from manufacturer's full range.
 - 10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cap: Surface bullnose, module size 4 by 12.
 - b. Surface bullnose, module size 4 by 12.
 - c. External Corners: Surface bullnose, module size 6 by 12.
 - d. Internal Corners: Field-butt square corners.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of [10] [12] in accordance with ASTM C1353/C1353M or ASTM C241/C241M and with honed finish.
 1. Description:
 - a. Uniform, fine- to medium-grained white stone with gray veining.

2.5 CRACK ISOLATION MEMBRANE AND UNCOUPLING MEMBRANE

- A. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Schluter Systems L.P.

2.6 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.2-mm) nominal thickness.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.

2.7 SETTING MATERIALS

- A. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Americas.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.8 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Americas.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.
- C. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blanke Corporation.
 - b. Custom Building Products.
 - c. Dural USA, Inc.
 - d. Profilitec Corp.
 - e. Progress Profiles America Inc.
 - f. Schluter Systems L.P.
 - 2. Description: Square.
- D. Material and Finish: TBD Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.
- E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- F. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with **bonded mortar bed or thinset mortar** comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with **thinset mortar** with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Substrate Flatness:
 - 1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

- A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- D. Mix mortars and grouts to comply with "Referenced Standards" Article in the Evaluations and mortar and grout manufacturers' written instructions.
 1. Add materials, water, and additives in accurate proportions.
 2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
- E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.
 1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches or larger.
 2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
 5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - b. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
 7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- G. Thresholds: Install stone and solid surface thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
- H. Grout Sealer: Apply grout sealer to [**cementitious**] grout joints [**in tile floors**] in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Ceramic Tile Installation: TCNA F132; water-cleanable, tile-setting epoxy on cured cement mortar bed bonded to concrete subfloor; epoxy grout.
 - a. Ceramic Tile Type: Porcelain Tile
 - b. Grout: Water-cleanable epoxy grout

END OF SECTION 093013

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.
4. Perimeter trim.

1.2 RELATED REQUIREMENTS

- ##### A. See Sheet A700 – "Interior Material Schedule".

1.3 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- ##### A. Product Data: For each type product.
- ##### B. Samples for Initial Selection: For components with factory-applied finishes.
- ##### C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color, including perimeter trim.
 3. Clips: Full-size seismic clips.
- ##### D. Delegated Design Submittals: For seismic restraints for ceiling systems.
1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- ##### A. Coordination Drawings: Reflected ceiling 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. Ceiling suspension-system members.
 2. Structural members to which suspension systems will be attached.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- E. Contractor shall provide a clear statement that acoustical ceiling panels, metal edge moldings and trim, and metal suspension system are the same manufacturer.
- F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 3. Seismic Clips: Equal to 2 percent of quantity installed.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.
- B. Seismic Performance: Suspended ceilings to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A in accordance with ASTM E1264.
 - 2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling as per "Interior Material Schedule" on Sheet A700 or similar products by the following:
 - 1. USG Corporation.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form, Type III: Mineral base with painted finish; Form 1, nodular
- D. Color: White.
- E. Light Reflectance (LR): Not less than 0.85.
- F. Ceiling Attenuation Class (CAC): 30
- G. Noise Reduction Coefficient (NRC): 0.85
- H. Articulation Class (AC): Not Applicable.
- I. Edge/Joint Detail: Angled tegular edge.
- J. Thickness: 3/4 inch.
- K. Modular Size: 24 by 24 inches.
- L. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude 15/16" or similar products by the following:
 - 1. USG Corporation.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.
 - 1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" in accordance with ASTM C635/C635M.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Fire Rating: None.
 - 2. Structural Classification: Heavy-duty system.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flat, flush.
5. Cap Material: Cold-rolled steel.
6. Cap Finish: Painted white.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- F. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; product or comparable product by the following:
 1. Armstrong Ceiling & Wall Solutions.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings to fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 PERIMETER CEILING EDGE TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; Compässe Elite; or approved equal.
- B. Description: Metal acoustical ceiling system perimeter trim or fascia that creates free-form ceiling islands to define spaces.
 - 1. Material: Extruded aluminum.
 - 2. Trim Height: As indicated on Drawings.
 - 3. Trim Depth: 1 inch.
 - 4. Trim Length: 10'-0".
 - 5. Color: Primer white.
- C. Accessories:
 - 1. Attachment Clip: Clip attaches grid to backside bosses on trim; Compäso Elite Attachment Clip by USG.
 - 2. Splice Plate: Steel in finish to match trim pans; formed for snap-fit into 8-inch pan ends, for use at cut ends of metal ceilings.
 - 3. Outside Corner Trim: 90-degree outside corner trim pieces trim; Compäso Elite Suspension Trim, 90-degree Outside Corner, Flat by USG.
 - 4. Indies Corner Trim: 90-degree Inside Corner, Flat; Compäso Elite Suspension Trim, 90-degree Inside Corner, Flat by USG.
 - 5. Lighting Clip: Channel clip attaches LED strips for decorative lighting mounted at top edge of edge trim. Use with "F" molding to secure LED light arrays to clips; Compäso Elite LED Channel Clip by USG.

2.8 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

- A. Install acoustical panel ceilings in accordance with ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches on center along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 12. See Sheet A120, Typical Seismic Ceiling Details, on Drawings.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches on center and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. Install panels with pattern running in one direction parallel to long axis of space.
 2. Cut edges to match angled tegular edge. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 3. Install seismic clips in areas indicated; space in accordance with panel manufacturer's written instructions unless otherwise indicated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Periodic inspection during the installation of suspended ceiling grids in accordance with ASCE/SEI 7.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
- D. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

1.4 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett comparable product by one of the following:
 - 1. Flexco Corporation.
 - 2. Roppe Corporation; Roppe Holding Company.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style: Style B, Cove:
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Cut lengths 48 inches long Coils in manufacturer's standard length.
- F. Colors: As selected by Architect from manufacturer's standard colors.
 - 1. See Sheet A700 – "Interior Material Schedule".

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.
2. Vapor barrier.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Sheet A700 "Interior Material Schedule".

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

E. Product Schedule: For floor tile.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard LVT product warranty for selected product.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE - LVT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Interface.; product or comparable product by one of the following:
 - 1. Congoleum Flooring.
 - 2. Gerflor USA.
 - 3. Mannington Mills, Inc.
 - 4. Patcraft; a division of Shaw Industries, Inc.
 - 5. Shaw Industries Group, Inc.; Berkshire Hathaway Company.
- B. Tile Standard: ASTM F 1700.
 - 1. Class: Class III, Printed Film Vinyl Tile.
 - 2. Type: B, Embossed Surface.
- C. Thickness: 0.100 inch.
- D. Size: As selected by the Architect – see sheet A700.
- E. Colors and Patterns: As selected by Architect from manufacturer's standards. See sheet A700.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Vapor Barrier: Basis-of-Design product: Spray-lock SCP578, or approved equal submitted during the bidding phase.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis and as indicated on approved shop drawings.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction and as indicated on approved shop drawings.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 096726 - SEAMLESS EPOXY FLOORING (SEF)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Seamless Epoxy Flooring (SEF), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Related Requirements
 - 1. Section 018113.53 "Sustainable Design Requirements – Green Globes" for additional project requirements, including but not limited to performance and submittal requirements that may apply to any product or procedure herein specified."

1.2 QUALITY ASSURANCE

- A. Minimum Performance Characteristics:
 - 1. Impact Resistance, Gardner Impact Test: Greater than 160 IN/LB, no cracking, chipping or delamination.
 - 2. Abrasion Resistance, ASTM D4060: Maximum 0.06 g.
 - 3. Flammability, ASTM E648; Class I.
 - 4. Tensile Strength, ASTM C307: At least 1,500 PSI.
 - 5. Compressive Strength, ASTM C579: At least 6,000 PSI.
 - 6. Slip Resistance Index, ASTM F1679: 0.81.
- B. Materials shall be recommended and manufactured by single supplier to insure compatibility and proper chemical and mechanical bond.
- C. Delivery, Storage, and Handling:
 - 1. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 - 2. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.
 - 3. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on-site weighing or volumetric measurements allowed.
- D. Project Conditions:
 - 1. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2. Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.
3. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
4. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
5. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring

E. Applicator Qualifications:

1. Applicator and all applicator personnel must be trained and certified by flooring manufacturer to install their product.
2. Applicator experienced in application of specified resinous flooring materials for a minimum of 7 years on projects of similar size and complexity and as approved by Architect.
3. Provide list of completed projects including project name and location, name of Architect, name of material manufacturer, and approximate quantity of materials applied.

F. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

G. Pre-installation Conference:

1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
2. Attendance:
 - a. General Contractor
 - b. Architect/Owner's Representative.
 - c. Manufacturer/Installer's Representative.

1.3 SUBMITTALS

A. Product Data:

B. Samples:

1. Three samples 12 IN square of each material specified in Color Schedule section 09 06 00.
2. Samples for review of color only.

C. Mock-up:

1. A site mock-up is required for final approval of texture and color. Architect and Owner must sign off on completed mock-up prior to installation of flooring.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2. Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
3. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Architect.
4. Include 48-inch (1200-mm) length of integral cove base.
5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Contract Closeout Information:

1. Maintenance data.
2. Warranty.

1.4 WARRANTY

- A. Manufacturer's written warranty against defects and wear for a period of five (5) years, including:
1. Delamination from substrate.
 2. Loss of aggregate.
 3. Degradation of finish.
 4. Cracking and spalling.
 5. Water penetration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Seamless Epoxy Flooring (SEF):
1. Base:
 - a. Stonhard
 2. Optional:
 - a. Dudick Inc.
 - b. Sika Industrial Flooring
 - c. Tnemec
- B. Other manufacturers desiring approval comply with Instructions to Bidders - Substitutions.

2.2 MATERIALS

- A. Seamless Epoxy Flooring System:
1. Stonhard: Basis of design, Stonshield HRI with Stonseal CA7
 2. System Characteristics:
 - a. Color and Pattern: As indicated in Color Schedule 09 06 00.
 - b. Wearing Surface: standard or medium texture as selected from manufacturer.
 - c. Integral Cove Base: 8" high

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- d. Overall System Thickness: 3/16 inch (5 mm).
- 3. System Components: Manufacturer's standard components that are compatible with each other and as follows:
 - a. Body Coat(s):
 - 1) Material Basis: HRI Mortar Base
 - 2) Resin: Epoxy.
 - b. Grout Coat:
 - 1) Material Basis: Stonkote CE4.
 - 2) Resin: Two component epoxy
 - 3) Formulation Description: 100% solids.
 - 4) Number of Coats: 1
 - c. Topcoat:
 - 1) Material Basis: Stonseal CA7
 - 2) Resin: UV resistant aliphatic urethane
 - 3) Two component
 - 4) Number of Coats: 1
- B. Accessory Materials
 - 1. Primer: Type recommended by manufacturer for substrate and body coats indicated. Formulation Description: Stonhard Stonblend Primer, 100% solids.
 - 2. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coats indicated. Use waterproofing membrane as indicated on drawings and only when resinous flooring application occurs above grade. Basis of design is Stonproof ME7.
 - 3. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
 - 4. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated. Allowances should be included for Stonflex MP7 joint fill material, and or CT5 concrete crack treatment.
- C. Accessory strips:
 - 1. Depth and style as required and recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces for defects, irregularities and conditions under which flooring is to be installed.
- B. Verify substrates are free of materials that may affect adhesion.
- C. Identify cracks and other surface defects which need repair prior to application of floor system.
- D. Inspect substrate for markers, paint and similar materials used for layout by others and take remedial action as necessary to remove layout line work to prevent bleed-through.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- E. Verify floors are level or meet indicated slope.
- F. Do not proceed with installation until unsatisfactory conditions have been corrected.
- G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

- A. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
- B. Prepare substrate in accordance with manufacturer's instructions.
- C. Fill construction joints and other non-moving joints with elastomeric sealant approved by maker of epoxy flooring system to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.
- D. If necessary, mask or cover adjacent surfaces or both, including fixtures, cabinetwork, equipment, and similar items by suitable means.
- E. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- F. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Mechanically prepare substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
 - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
 - 3. Verify that concrete substrates are dry.
 - a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.
 - b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. of slab in 24 hours.
 - c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
 - 4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- G. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- H. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- I. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment.

3.3 INSTALLATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated. Install accessory strips at base and edge terminations in adhesive, or use concealed mechanical anchorages.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - 4. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.
- C. Install cove base to height of 105mm 4 IN with 25mm 1 IN radius cove.
 - 1. Stonshield cove base mortar, apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
 - 2. Trowel apply vertical base coat and hand sand.
 - 3. Do not allow resin to puddle in cove.
 - 4. Caulk top edge of base to seal.
- D. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using steel finishing trowels or power trowel material using manufacturer's specially designed power trowel blades.
- E. Apply aggregate as recommended by manufacturer for specified finish consistency.
 - 1. Match textures on approved mock-up.
- F. Surface irregularities. Mix and apply sealer with strict adherence to manufacturer's installation procedures.
- G. Mar Resistant Finish: Lightly sand or scrape surface to remove any floor surface irregularities. Mix and roller apply mar resistant finish with strict adherence to manufacturer's installation procedures.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- H. Apply seal coating uniformly over surfaces to satin finish.
- I. Finished work shall match approved samples; be uniform in thickness, sheen, color, pattern, and texture; and free from defects detrimental to performance.

3.4 TERMINATIONS

- A. Chase edges to "lock" the coating system into the concrete substrate along lines of termination.
- B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.
- C. Trenches: Continue coating system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.
- D. Treat floor drains by chasing the coating to lock in place at point of termination.

3.5 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
 - 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 - 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 PROTECTION

- A. Provide non-staining protection for finished flooring until building is ready for occupancy.
- B. Comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.7 FINAL CLEANING

- A. Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION 096726

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.
2. Vapor barrier.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.

C. Samples for Initial Selection: For each type of carpet tile.

D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.8 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- C. Do not install carpet tiles over concrete slabs with pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 15 years from date of invoice.

PART 2 - PRODUCTS

2.1 CARPET TILE – CT-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Interface; Open Air 423 or comparable product by one of the following:
 - 1. Milliken & Company.
 - 2. Mohawk Carpet, LLC; The Mohawk Group.
 - 3. Shaw Industries Group, Inc.; Berkshire Hathaway Company.
- B. Color: #107092 Linen.
- C. Pattern: Match Architect's samples.
- D. Pile Characteristic: Tufted textured loop.
- E. Density: 8,620 oz./cu. yd.
- F. Pile Thickness: 0.07 inch for finished carpet tile.
- G. Stitches: 9.0 per inch.
- H. Surface Pile Weight: 17 ounces per square yard
- I. Primary Backing/Backcoating: Manufacturer's standard vinyl composite materials.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

J. Size: 50cm by 50 cm.

K. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.

L. Performance Characteristics:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Dry Breaking Strength: Not less than 100 lbf according to ASTM D2646.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Vapor Barrier: Basis-of-Design product: Spray Lock SCP578 or approved equal submitted during the bidding phase.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer and as indicated on approved shop drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 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. Paint Products: 5 percent, but not less than 1 gallon of each material and color applied.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 degrees and 95 degrees F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 degrees F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products or comparable products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints; PPG Industries, Inc.
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.
 - 1. See Sheet A700 – "Interior Material Schedule".

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Wood: 15 percent.
 - 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

E. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board:
 - 1. Application includes gypsum wallboard at walls in typical areas.
 - 2. System:
 - a. Primer: ProMar 200 Zero-VOC Latex Primer
 - b. Finish (2 coats): ProMar 200 Zero VOC Latex Eg-Shel
 - c. Color: As selected by Architect from manufacturer's standard colors.
- B. Gypsum Board:
 - 1. Application includes gypsum wallboard at ceilings in typical areas.
 - 2. System:
 - a. Primer: ProMar 200 Zero-VOC Latex Primer
 - b. Finish (2 coats): ProMar 200 Zero VOC Latex Flat
 - c. Color: As selected by Architect from manufacturer's standard colors.
- C. Gypsum Board:
 - 1. Application includes gypsum wallboard walls and ceilings in wet areas.
 - 2. System:
 - a. Primer: ProMar 200 Zero-VOC Latex Primer
 - b. Finish (2 coats): Pro Industrial Waterbased Catalyzed Epoxy, Eg-Shell
 - c. Color: As selected by Architect from manufacturer's standard colors.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

D. Steel (Shop Primed):

1. Application includes hollow metal doors and frames, typical.
2. System:
 - a. Primer: ProMar 200 Zero-VOC Latex Primer
 - b. Finish (2 coats): Pro Industrial Waterbased Alkyd Urethane, Semi-Gloss
 - c. Color: As selected by Architect from manufacturer's standard colors.

E. Wood - Paint:

1. Application includes wood trim, typical.
2. System:
 - a. Primer: Premium Wall & Wood Primer
 - b. Finish (2 coats): ProMar Acrylic-Alkyd Semi-Gloss.
 - c. Color: As selected by Architect from manufacturer's standard colors.

END OF SECTION 099123

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 101423 - ROOM-IDENTIFICATION PANEL SIGNAGE

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 room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standards.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Room Signage Schedule: Contractor to prepare final sign schedule for Architect's review using room names per floor plans and the attached schedule.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Room-Identification Signs: Full-size Sample.
 - 2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 - 3. Include representative Samples of available typestyles and graphic symbols.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.7 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. Tools: Two set(s) of specialty tools for assembling signs and replacing variable sign components.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Basis of Design Manufacturer: Provide signs by Graphic Specialties, Inc. (GSI). Subject to compliance with requirements, other available manufacturers offering

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

similar products that may be incorporated into the Work may be considered with prior approval.

2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
 - b. Subsurface Graphics: Slide-in changeable insert.
 - c. Color(s): As selected by Architect and Owner.
3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition Square cut.
 - b. Corner Condition in Elevation: Rounded to radius indicated.
4. Frame:
 - a. Material:
 - 1) Aluminum, 1/4" square end caps at vertical edges.
 - 2) 3/8 inch wide maple laminate strip at top edge.
 - 3) 1/4" square separator bar
 - 4) Back panel: 0.080 aluminum
 - b. Finish and Color: As selected by Architect and Owner.
5. Mounting: Surface mounted to wall with double sided foam tape.
6. Text and Typeface: Accessible raised characters and Braille, typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.
- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Double sided foam tape.
 - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 - a. Fastener Heads for frames: Use flathead screws. With anchors, according to partition type of surface.
 - 3. Sign Mounting Fasteners: Panel which requires special tool to remove from frame.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
- B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
 - 1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner. Furnish two blank inserts for each sign for Owner's use.
 - 2. For frame to hold sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Interior Signs: brushed mill finish.
- B. Exterior Signs: Clean Anodized.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
 - 1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 - 2. Where mounting signs on glass, install matching blank panel on opposite side of glass, sized to match sign panel.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

ROOM IDENTIFICATION SIGNAGE SCHEDULE

ROOM/DOOR	SIGN TYPE	TEXT	SYMBOL
103	A	VIEWING ROOM	
104	A	CORRIDOR	Do Not Enter
105	C	PUBLIC TOILET ROOM	M/F/HC
106	C	TOILET ROOM	M/F/HC
107	C	TOILET ROOM	M/F/HC
108	A	JANITOR CLOSET	
109	B	CORONER'S OFFICE	
110	B	TOILET ROOM	M/F/HC
111	A	ELECTRICAL	
112	B	OFFICE	
113	B	RESTING ROOM	
114	A	JANITOR	---
115	B	OFFICE	
116	A	BREAK ROOM	
118	B	RECEPTION	
119	A	STORAGE	
120	B	CONFERENCE ROOM	
121	A	AUTOPSY VESTIBULE	
122	A	MECHANICAL	
123	B	AUTOPSY ROOM	
124	C	TOILET ROOM	M/F/HC
125	A	LOCKER / LAUNDRY	
126	A	EVIDENCE STORAGE	

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Public-use washroom accessories.
 - 2. Shower room accessories.
 - 3. Bathroom accessories.
 - 4. Custodial accessories.
- B. Related Sections:
 - 1. Section 093013 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
 - 6. Tubular Specialties Manufacturing, Inc.
- B. Toilet Tissue (Roll) Dispenser: Furnished and installed by Owner's provider.
- C. Paper Towel Dispenser: Furnished and installed by Owner's provider.
- D. Waste Receptacle:
 - 1. Basis-of-Design Product: Bradley, Model #346.
 - 2. Description: Semi-recessed 12 gallon capacity.
 - 3. Provide 1 each toilet/shower room.
- E. Liquid-Soap Dispenser: Furnished and installed by Owner's provider.
- F. Napkin Disposal:
 - 1. Basis-of-Design Product: Bradley Model 4781-11.
 - 2. Description: Surface mounted.
 - 3. Liners: Provide box of 500 liners, Bradley P11-022.
- G. Grab Bar:
 - 1. Basis-of-Design Product: Bradley, Model 812 series.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: W.C.'s Smooth, No. 4 finish (satin).
 - b. Finish: Showers, smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 4. Outside Diameter: 1-1/2 inches (38 mm).
 - 5. Configuration and Length: As indicated on Drawings.
- H. Wall mounted hand sanitizer dispenser: Furnished and installed by Owner's provider.
- I. Baby Changing Table: Bradley #962, recess mounted.

2.3 SHOWER ROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
6. Tubular Specialties Manufacturing, Inc.

B. Folding Shower Seat:

1. Basis-of-Design Product: Bradley,
2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).

C. Robe Hook:

1. Basis-of-Design Product: Bradley 9124
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).
4. Provide 1 per shower and on back of each toilet door, and see drawings for locations.

D. Shower Curtain Rod:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. (Basis of Design): Bradley Model 9539.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. GAMCO Specialty Accessories; a division of Bobrick.
2. Description: 1-1/4-inch- (32-mm-) outside diameter, straight rod.
3. Configuration: As indicated on Drawings.
4. Mounting Flanges: Concealed fasteners; in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

E. Shower Curtain:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. (Basis of Design): Bradley Model 9533.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. GAMCO Specialty Accessories; a division of Bobrick.
2. Size: Minimum 60 inches wide by 72 inches (1829 mm) high.
3. Material: Nylon-reinforced vinyl, minimum 9 oz. (255 g) or 0.008-inch- (0.2-mm-) thick vinyl, with integral antibacterial and flame-retardant agents.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

6. Shower Curtain Hooks: Stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet. Bradley 9536.

2.4 CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. A & J Washroom Accessories, Inc.
 2. American Specialties, Inc.
 3. Bobrick Washroom Equipment, Inc.
 4. Bradley Corporation.
 5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
 6. Tubular Specialties Manufacturing, Inc.
- C. Custodial Mop and Broom Holder:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. (Basis of Design): Bradley Model 9933.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. GAMCO Specialty Accessories; a division of Bobrick.
 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 3. Length: 36 inches (914 mm).
 4. Hooks: Four.
 5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than 18 gauge stainless steel.

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of exposed finish required.

D. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Fire Equipment, Inc.
 - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - c. Larsen's Manufacturing Company.
 - d. Nystrom, Inc.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Aluminum sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Aluminum sheet.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color:
 - a. Clear transparent acrylic sheet.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words " FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

K. Materials:

1. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
 - a. Finish: Clear anodic.
2. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 1.5 mm thick, with Finish 1 (smooth or polished).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- required by NFPA 10 is within the warranty period.
- b. Faulty operation of valves or release levers.
- 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Fire Equipment, Inc.
 - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - c. Larsen's Manufacturing Company.
 - d. Nystrom, Inc.
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type UL-rated 5 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

requirements of authorities having jurisdiction.

END OF SECTION 104416

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 107300 – ALUMINUM CANOPY –POST SUPPORTED

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Work in this section includes furnishing and installation of extruded aluminum overhead post supported canopies.

1.2 QUALITY ASSURANCE

- A. Manufacturer with 10 years or more experience.

1.3 SUBMITTALS

- A. Shop drawings
- B. Samples
- C. Manufacturer's standard warranty.

1.4 PERFORMANCE REQUIREMENTS

- A. IBC 2021, and wind and seismic loads shown on the structural drawings, and ASCE 7.
- B. Delegated Design: PE Stamped calculations are required and must be signed and sealed by an engineer licensed within the state of South Carolina.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by Mapes Canopies, Peachtree Protective Covers, Inc., or Dittmer Architectural Aluminum.

2.2 MATERIALS

- A. Decking shall consist of 2 ½" or 2 ¾" extruded .078" decking.
- B. Intermediate framing members extruded aluminum,
- C. Fascia 8" extruded J style

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- D. Beams: 6" X 10". Posts: 6" X 6".

2.3 FINISHES

- A. 3 coat kynar. Color to be selected from manufacturer's full range of options.

2.4 FABRICATION

- A. Concealed drainage.

PART 3 - EXECUTION

- A. Installation shall be in strict accordance with manufacturer s shop drawings. Particular attention should be given to protecting the finish during handling and erection.

END OF SECTION 107300

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

B. Related Requirements:

1. Section 064116 "Plastic-Laminate-Clad Architectural Cabinets" for cabinets.
2. Division 22 for sinks.
3. Sheet A700 – "Interior Material Schedule".

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches of construction and in configuration specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets and other supporting structures are installed but before countertop fabrication is complete.

1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.
- B. Coordinate countertops with reception desk details.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
 - 1. Basis-of-Design: Provide Wilsonart LLC or similar products by one of the following:
 - a. DuPont; DuPont de Nemours, Inc.
 - b. Durasein Solid Surface; a brand of Relang International, LLC.
 - c. Formica Corporation.
 - d. LG Hausys, Ltd.
 - 2. Colors and Patterns: See Sheet A700 – "Interior Material Schedule".
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops:

1. 1/2-inch- thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch- thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints:

1. Fabricate countertops without joints.
2. Fabricate countertops in sections for joining in field , with joints at locations indicated on approved shop drawings and the following:
 - a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

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. This Section describes the common work requirements for the plumbing work included in Division 22 and applies to all sections of Division 22.
- B. Related Sections:
 - 1. Section 013150 "Coordination Drawings" for coordination drawing requirements.

1.3 DEFINITIONS

- A. Following are definitions of terms and expressions used in the Mechanical and Electrical Sections:
 - 1. Provide: Furnish and install
 - 2. Directed: Directed by the Architect or Engineer
 - 3. Indicated: Indicated in Contract Documents
 - 4. Concealed: Hidden from normal sight; includes items within furred spaces, pipe and duct shafts, above suspended ceilings and within return air plenums.
 - 5. Exposed: Non-concealed - Work within Equipment Rooms shall be considered exposed.
 - 6. Exterior: Items being or situated outside. Items located within a crawl space shall be considered exterior.
 - 7. Conditioned: Heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means, so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.
 - 8. Piping: Includes pipes, fittings, valves, hangers, and accessories comprising a system.
 - 9. Architect: Principal design professional for the project. In certain types of projects, the principal design professional may be an engineer rather than an architect. For such projects, within the bounds of these specifications, where the term "architect" is used, it may refer instead to the engineer.

1.4 CODES, REGULATIONS, AND PERMITS:

- A. References to codes, standards, specifications, and regulations apply to the latest edition adopted by the jurisdiction where the project is located.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. All materials furnished and all work installed shall comply with the applicable rules, regulations, and recommendations of the following bodies:
 - 1. International Building Code
 - 2. International Existing Building Code
 - 3. International Mechanical Code
 - 4. International Plumbing Code
 - 5. International Fire Code
 - 6. International Energy Code
 - 7. National Electric Code
 - 8. National Fire Protection Association Standards
 - 9. State Fire Marshal Regulations
 - 10. Local Fire Marshal Regulations
 - 11. ASHRAE Standards and Handbooks (Latest Editions)
 - 12. Local Health Department
 - 13. State Health Department
 - 14. Local Utility Companies
 - 15. Underwriters Laboratories
 - 16. Owner's Insurance Underwriter Standards
 - 17. Environmental Protection Agency
- C. Give all necessary notices, obtain all permits, and pay all fees and other costs, including those for utility connections or extensions in connection with the work. File all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction. Obtain all required certificates of inspection and deliver same to the Architect before request for acceptance and final payment for the work.

1.5 SUBMITTAL MANAGEMENT AND REVIEW CAPACITY

- A. Refer to Section 013300 "Submittal Procedures" for additional information on scheduling, coordination and procedures.
- B. Submittal Schedule
 - 1. Submittals shall be transmitted in accordance with the approved Submittal Schedule. Submittals that deviate substantially from the approved schedule may be deferred and reviewed based on available review capacity.
- C. Submittal Packaging and Coordination
 - 1. Submittals shall be prepared and transmitted as complete, coordinated packages organized by individual Specification Sections.
 - 2. Each submittal package shall:
 - a. Include all supporting product data, shop drawings, schedules, calculations, and coordination information required for review.
 - b. Bear the Contractor's review and approval stamp confirming coordination with other Work of the Contract and for compliance with the Contract Documents.
 - 3. Submittals that are incomplete, improperly formatted, uncoordinated, or lacking the Contractor's approval stamp may be returned without review. In such cases, the review period shall not commence until a complete and acceptable submittal package is received.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For plumbing systems and specialties to include in emergency, operation, and maintenance manuals.
- B. Plumbing Submittals/Shop Drawings
- C. Plumbing Warranties
- D. Water Quality Test Report
- E. DHEC Sewer Test
- F. Pressure Test Reports

1.7 EQUIPMENT LIST

- A. Provide a spreadsheet list of all equipment provided with the drawing tag number or designation, name, manufacturer, model number, serial number and full electrical characteristics.
- B. This list shall be provided to the TAB agent to the Owner prior to beginning TAB work and as soon after all equipment is received on site.

1.8 EQUIPMENT START-UP AND INITIAL OPERATION

- A. No equipment shall be operated, for testing or trial use, before full compliance with the equipment manufacturers' specifications and instructions for the lubrication, alignment, direction of rotation, balance, and other applicable considerations.
- B. Particular care shall be taken to see that all equipment is completely assembled, properly lubricated, and all grease and oil cases and reservoirs have been filled to the correct level with the recommended lubricants.
- C. It is the Contractor's responsibility to place each item of equipment, installed by him, in operating condition. This responsibility includes all auxiliaries, piping, wiring, etc., the start up of each unit, and a check of its performance.

1.9 PROTECTION

- A. Protect piping and equipment from moisture, construction debris and dust, and other foreign materials.
 - 1. Open ends on stored, completed and in-progress work, as well as overnight work-in-progress, shall be sealed.
 - 2. Protective coverings shall only be removed immediately before installation or new work, and inspected to determine if additional wipe down is necessary.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Refer to Section 017900 "Demonstration and Training"
- B. Upon completion of all work and all tests, Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment.
- C. Contractor shall instruct the Owner's representative fully in the operation, adjustment, and maintenance of all equipment furnished.

1.11 SITE VISIT

- A. Prior to preparing the bid, it is recommended that the Contractor and subcontractors shall visit the site and familiarize themselves with all existing conditions, make all necessary investigations as to locations of utilities, and all other matters which can affect the work.
- B. No additional compensation will be made to the Contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.12 DRAWINGS

- A. The Contract Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Any offsets, rises, or transitions not shown on the drawings and required to provide a complete system shall be provided at no additional contract cost. Do not scale the drawings. Consult the Architectural and Structural drawings and details for exact location of structure and equipment; where same are not definitely located, obtain this information from the Architect.
- B. In the event of ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of work, or 2) comply with the more stringent requirement. Either or both in accordance with the Architect's interpretation.

1.13 SINGULAR NUMBER

- A. Where any device or part of equipment is herein referred to in the singular number (such as "valve"), such reference applies to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to Section 013300 "Submittal Procedures" for additional information.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. For each specified product, provide from single manufacturer. Do not mix and match various manufactures for a single product. If various manufacturers are required for a single product, indicate reason and locations where each will be installed.
- C. All component parts of each items of equipment or device shall bear the manufacturers' name plate; giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate the maintenance or replacement. The name plate of a subcontractor or distributor will not be acceptable. Where Underwriters' Laboratories standards apply, material and equipment shall be approved by them and shall bear the UL Label.
- D. In specifying materials, three (3) general procedures are used. The three (3) classifications are as follows:
 - 1. GROUP 1: When a material or equipment is specified by brand name or other identifying information and three (3) or more brands are named it is considered that any one (1) of the brands so named will perform as desired, and the Contractor shall base his proposal on one (1) of the named brands. The first brand named or identified basis of design shall be used as a standard. The other brands named shall be equal to the specified brand in all respects. If one (1) of the other brands named is used it shall be the Contractor's responsibility to verify proper clearances and fit of the substituted equipment.
 - 2. GROUP 2: When the material or equipment is specified with the phrase "...or approved equal..." after a brand name and other identifying information, it is intended that the brand name is used for the purpose of establishing a minimum acceptable standard of quality and performance and Contractor may base his bid proposal on any item which is in all respects equal to that specified and presents essentially the same appearance. It shall be the Contractor's responsibility to ensure proper fit and clearances of all substituted equipment.
 - 3. GROUP 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, American Society of Testing and Materials, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects to the referred "Standard Specification".
- E. It is distinctly understood: (1) that the Architect will use his own judgment in determining whether or not any materials, equipment or methods offered in substitution are equal to those specified; (2) that the decision of the Architect on all such questions of equality is final; and (3) that all substitutions will be made at no increase in cost to the Owner.
- F. Upon receipt of written approval from Architect, Contractor may proceed with substitution providing Contractor assumes full responsibility for, and makes, at his own expense, any changes or adjustments in construction or connection with other work that may be required by the substitution of such materials, equipment or methods. In the event of any adverse decisions by the Architect no claim of any sort shall be made or allowed against the Owner.
- G. All pipe and fittings shall be from a United States domestic manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.2 FIRE-RATED PENETRATIONS

- A. Provide UL Listed fire penetration systems in openings in rated floors, walls, and other elements of construction. Provide UL listed fire penetration systems at all new and existing pipe penetrations of new and existing rated construction within the area of work. Coordinate work of this section with all other trades necessary for the proper installation of the fire rated penetration systems.
- B. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications. Submit copies of manufacturer's specifications, recommendations, inspection requirements, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
- C. All fire penetration systems shall reference ASTM E814/UL 1479 - Fire Test of Through - Penetration Fire Stops.
- D. All systems shall be UL tested and listed in the UL Fire Resistance Directory.
- E. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one (1) year from date of substantial completion.
- F. 3M products have been specified as the penetration fire stop basis of design. Other manufacturer's systems are acceptable providing they meet the requirements set forth in this specification. The fire rated penetration systems shall be the products of one manufacturer to the maximum extent possible. The products of more than one manufacturer shall not be used as a combined seal.
- G. Provide materials classified by UL to provide fire stopping equal to time rating, both "F" and "T" ratings, of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814. Systems shall be smoke and air tight.
- H. Deliver material undamaged in manufacturer's clearly labeled, unopened containers identified with brand, type, grade, and UL label where applicable. Coordinate delivery with scheduled installation date to allow minimum storage time at site. Store material in clean, dry ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instruction.
- I. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- J. Furnish adequate ventilation if using solvent. Furnish forced air ventilation during installation if required by manufacturer. Keep flammable materials away from sparks or flame. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping resistance.
- K. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose, materials, rust, or other substances that may affect proper fitting, adhesion of the required fire resistance.
- L. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instructions. Seal holes or voids made by penetrations to ensure an effective smoke barrier. Where floor openings without penetrating items are more than four (4) inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor. Protect materials from damages on surfaces subject to traffic.
- M. Clean up spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- N. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by local inspectors and other trades.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. The quality of workmanship required, for each trade, in the execution of work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Architect and his decision as to acceptable quality is final.
- B. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.2 EQUIPMENT PERFORMANCE

- A. All equipment, devices, controls, and hardware shall be proven to operate successfully throughout the guarantee period. Systems shall be proven during all-weather seasons and be demonstrated to affect the design conditions at times. System components or equipment items that fail to consistently deliver the design conditions shall be removed and replaced as directed by the Architect. The cost of required equipment replacements shall be borne by the Contractor.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. All equipment shall be tested after installation and be proven to deliver the manufacturers quoted design capacity. When capacity is in question as deemed by the Architect, the Contractor shall perform a detailed and comprehensive field performance test to certify the equipment capacity. System effect or installed performance factors may not be applied to performance ratings unless they were previously included when the equipment was submitted for approval. Equipment that fails to deliver manufacturers quoted design capacity shall be removed and replaced at the Contractors expense.
- C. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.3 EQUIPMENT CONNECTIONS

- A. All equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, piping specialties, water seals, valves, and electric connections recommended by the manufacturer, required by code or required for proper operation shall be provided.

3.4 CUTTING AND PATCHING

- A. Cutting and patching associated with the work shall be performed in a neat and workmanlike manner. Existing surfaces, which are damaged by the Contractor, shall be repaired or provided with new materials. All patching shall be done with materials and methods similar to existing adjacent work, subject to approval of the Architect. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by reciprocating or rotary, non-percussive methods.
- B. Patching of areas disturbed by installation of new work shall match existing adjacent surfaces in material, texture, and color.

3.5 PROTECTION OF EXISTING WORK

- A. When working in and around the building, extreme care shall be exercised with regard to protection of the structure and plumbing services. Repair or replace, to the satisfaction of the Architect, any existing work damaged in the performance of the new work.

3.6 SURVEYS AND MEASUREMENTS

- A. Base all measurements (both horizontal and vertical) from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check correctness of same as related to the work. Verify locations of existing

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

utilities and inverts of same prior to the start of any systems shown connecting to existing utilities.

- B. Should the Contractor discover any discrepancy between actual measurements or conditions, and those indicated, which prevent following good practice or the intent of the drawings and specifications, he shall notify the Architect and shall not proceed with his work until he has received instruction from the Architect.

3.7 HANDLING AND STORAGE OF MATERIAL

- A. Proper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment and materials so that no equipment or materials are damaged.
- B. All equipment delivered to the job site shall be stored on pedestals, above the ground and under roof or other approved covering. All enclosures for equipment shall be weatherproof. All motors, drives, switchgear, panels, etc. which are not totally enclosed, that are involved in the work, shall be stored in a heated, dry, water protected area with a minimum temperature of fifty degrees (50) Fahrenheit. All valves shall be stored under roof on wood pedestals, above ground. All insulation shall be stored under roof or in trailers, adequately protected from the weather. The Contractor shall follow all written instructions and recommendations of the manufacturer and all requirements of the Architect in oiling, protection and maintenance of equipment during storage. It shall be the Contractor's complete responsibility for the storage and care of the equipment and materials.
- C. If any equipment and/or materials are found to be in poor condition at the time of installation the Architect may, at his discretion, order the Contractor to furnish and install new equipment and/or material at no cost to the Owner.

3.8 COOPERATION WITH OTHER TRADES

- A. Plumbing trades shall give full cooperation to other trades and shall furnish in writing, with copies to Architect any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay. Exact location of all plumbing and equipment, devices, etc. in finished spaces shall be coordinated with Architectural reflected ceiling plans, elevations and details.

3.9 CLEANING AND PATCHING

- A. Thoroughly clean all exposed surfaces of equipment and material and leave in a neat, clean condition.
- B. Restore and touch-up factory finishes which have been damaged during construction.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.10 ACCESSIBILITY

- A. Equipment shall be installed per manufacturer's recommended clearance guidelines with sufficient space for maintenance personnel service, operate, and maintain equipment.
- B. Locate all above ceiling equipment which must be serviced, operated, or maintained, in fully accessible positions to eliminate the need for access panels and doors. Equipment shall include, but not be limited to, valves, clean-outs, motors, controllers, dampers, drain points, etc.
- C. Where overhead equipment cannot be located above spaces with either no ceilings or removable acoustical ceiling tiles, contractor shall provide, as part of the contract and no expense to the Owner, fourteen (14) gauge painted steel access doors where required and/or where directed (color shall match ceiling).
 - 1. Access doors shall be Milcor or approved equal to suit material in which installed.
 - 2. Access doors installed in fire rated walls or shafts shall be labeled and shall match rating of the construction.
 - 3. Doors shall be of sufficient size to allow access to all components; minimum size shall be eighteen (18) inches by eighteen (18) inches.
 - 4. Doors in Toilet Rooms and Janitor's Closets shall be Type 304 stainless steel.
 - 5. All doors shall have cylinder locks operable from same key.
 - 6. Submit shop drawings for approval. Locations shall be coordinated with the Architect and indicated on the composite installation and coordination drawings
- D. Equipment deemed inaccessible by the Architect shall be reworked by the Contractor at no expense to the Owner.

3.11 EXCAVATION AND BACKFILL

- A. Refer to Section 312000 "Earth Moving" for additional requirements.
- B. Definitions:
 - 1. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - a. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - b. Final Backfill: Backfill placed over initial backfill to fill a trench.
 - 2. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
 - 3. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 4. Fill: Soil materials used to raise existing grades.
 - 5. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
 - 6. Utilities: On-site underground pipes, as well as underground services within buildings.
- C. Soil Materials:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter
 2. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
 - a. Unsatisfactory soils include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
 3. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
 4. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
 5. Sand: ASTM C 33/C 33M; fine aggregate.
- D. Excavation for Utility Trenches:
1. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - a. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe unless otherwise indicated.
 - a. Clearance: 12 inches each side of pipe.
 3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes on solid, undisturbed earth for the full length of each pipe, except for that portion at the bell holes. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - d. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
 4. Any part of the trench bottom excavated below the specified subgrade shall be backfilled, at the Contractor's expense, with bedding course materials.
 - a. For utility trenches, compact bedding course soil material at 95 percent.
 5. Whenever wet, or otherwise unstable, subgrade is encountered below the elevation of the original ground surface which existed prior to the time of construction, such soil shall be removed to the depth and extent direct by the Architect and the trench backfilled to the proper grade with bedding material as

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

hereinafter specified. Reimbursement for extra work performed by the Contractor shall be in accordance with the General Conditions.

6. Provide shoring and sheet piling necessary for excavation and for the safety of personnel and property as directed. Unless otherwise directed, the sides of all excavations over four (4) feet deep must be braced. All shoring, bracing, sheet piling, etc., must be solidly installed heavy timber suitable for the purpose. No lumber shall be buried when excavations are backfilled, except by authority of the Architect.

E. Subgrade Inspection

1. Notify Architect when excavations have reached required subgrade.
2. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
3. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

F. Utility Trench Backfill:

1. No backfill and/or bedding shall be placed until the construction adjacent thereto or the utility to be backfilled has been inspected, tested and approved. Notify the Architect when inspections are required.
2. Place backfill and beddings on subgrades free of mud, frost, snow, or ice.
3. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes.
4. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03.
5. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03.
6. Backfill voids with satisfactory soil while removing shoring and bracing.
7. Initial Backfill:
 - a. Soil Backfill: Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe.
 - 1) Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping to avoid damage or displacement of piping.
 - 2) Backfill for plastic pipe shall be clean sand, free of foreign materials.
 - 3) Coordinate backfilling with utilities testing.
8. Final Backfill:
 - a. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
9. Whenever the Architect requires the removal of wet or otherwise unstable subgrade from the fill material previously placed by the Contractor, the cost of all removal of unstable soil, together with backfilling of the trench as herein specified shall be borne by the Contractor.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

10. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

G. Compaction of Soil Backfills and Fills

1. Following inspection as specified above, approved backfill material shall be deposited in the trench with hand shovels, not by means of wheelbarrows, carts, trucks, bulldozers, or similar equipment.
2. Place backfill and fill soil materials in layers not more than 4 inches in loose depth for material compacted by hand-operated tampers until the pipe has a cover of not less than two (2) feet. The remainder of the backfill material shall then be deposited in the trench in eight (8) inch layers and compacted.
3. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
4. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:
 - a. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent of dry weight compaction.
5. Mechanical tampers, for compacting backfill, shall be tampers capable of exerting a blow equal to 250 foot-pounds per square foot (FT²) of area of the tamping face.
6. Work broken or ruptured by improperly placed backfill shall be removed and replaced by the Contractor at no additional cost to the Owner.
7. Any trenches improperly backfilled shall be reopened, then refilled and compacted to the required grade and smoothed off.

H. Field Quality Control

1. Test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
 - a. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet or less of trench length but no fewer than two tests.
2. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.12 EQUIPMENT BASES AND SUPPORTS

- A. Concrete bases, curbs, and supports will be furnished and installed under this Division and shall be in accordance with Division 3.
- B. The Subcontractors shall furnish, to the General Contractor, all required foundation sizes, bolts, washers, sleeves, plates and templates for equipment.
- C. The size of the foundation bolts shall be as recommended by the manufacturer.
- D. All equipment shall be set on the foundations, shimmed level with steel shims, and grouted up under base for uniform bearing by the Subcontractor.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. Under this Section, provide all equipment supports; consisting of inertia pads, platforms, gratings, structural members and related materials required for the mechanical and electrical work.
- F. The type and size of the supporting channels and supplementary steel shall be determined by the Subcontractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

3.13 DEMOLITION

- A. All existing piping, conduit, equipment and materials not required for re-use or re-installation shall be removed. Any existing materials and equipment which are removed and are desired by the Owner or are indicated to remain the property of the Owner, shall be delivered to him on the premises by the Contractor where directed by the Architect. All other materials and equipment which are removed shall become the property of the Contractor and shall be removed by him from the premises.
- B. Existing piping that remains concealed, buried, or otherwise contained in the remaining slabs and walls shall be capped, plugged, or otherwise sealed. All pipes shall be cut so that their capped or plugged ends will be below the finished floors or behind finished surfaces.
- C. Existing wiring, where possible, shall be removed or pulled through conduits. Wiring remaining shall be cut back behind the termination of conduits so that conduits can be adequately capped, plugged, or sealed.

3.14 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. When existing plumbing work is removed, all pipes, valves and materials shall be removed to a point below the finished floors or behind finished walls and capped. Such points shall be far enough behind finished surfaces to allow for the installation of the normal thickness of finished material.
- B. When the work specified hereinafter connects to existing equipment or piping, the Contractor shall perform all necessary alterations, cuttings, or fitting of existing work as may be necessary or required to make satisfactory connections between the new and existing work and to leave the completed work in a finished and workmanlike condition, to the entire satisfaction of the Architect.
- C. When the work specified hereinafter or under other divisions of the contract necessitates relocation of existing equipment, piping, or ductwork, the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike condition, to the satisfaction of the Architect. All work resulting in an extra to the contract shall be approved by the Owner and Architect before proceeding.
- D. All cutting and patching necessary for the installation of the plumbing work shall be done under this Division. Any damage done to the work already in place shall be

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

repaired at the Contractor's expense. Patching shall be uniform in appearance and shall match the surrounding surface.

- E. When the work specified hereinafter connects to existing piping, to avoid possible cross-connection of supply and return lines, the Contractor shall field verify the configuration of supply and return lines, using an appropriate temperature sensing or pressure device, before making final connections. Any discrepancy between construction documents and field verification should be promptly reported to the Architect before completing piping installation, so proper piping configuration can be verified.

3.15 INTERRUPTION OF EXISTING UTILITIES

- A. Notify the Owner in writing at least ten (10) calendar days in advance of any required shutdown of water, sewage, gas, electrical service or other utility. Upon written receipt of approval from Owner, shutdowns shall be performed between the hours of six (6) p.m. and six (6) a.m. including clean-up or as directed otherwise and shall be accomplished at no additional cost.
- B. At the end of each interruption, all services shall be restored so that normal use of the building can continue.

END OF SECTION 220500

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, induction motors for use on alternating-current power systems and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

1.4 SUBMITTALS

- A. Shop Drawings and Product Data: Shop drawings and product data for motors shall be provided with the submittal package for the piece of equipment that it serves. In accordance with Division 01, Section "Submittals" provide the following:
 - 1. Product catalog data: nameplate data and ratings; materials of construction; mounting arrangement, size and location of motor terminal box and conduit entry, grounding lugs and coatings.
- B. Warranties
 - 1. In addition to the warranty requirements of the General Conditions, warranties for each motor shall be covered in the warranty for the entire mechanical assembly (fan & motor, pump and motor, etc).
- C. Manufacturer Seismic Qualification Certification: Submit certification that motors, accessories, and components will withstand seismic forces defined in Division 23, Section "Mechanical Vibration, Sound and Seismic Controls. Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Operation and Maintenance Data: For factory-installed motors to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain factory-installed motors through one source from a single manufacturer.
- 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. Comply with NFPA 70, "National Electrical Code."
- D. NRTL Listing: Motors shall be NRTL-listed.
 1. Term "Listed": As defined in "National Electrical Code," Article 100.
 2. Listing Agency Qualifications: "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.
- E. Comply with NEMA MG 1, "Motors and Generators."
- F. Comply with UL 1004, "Motors, Electric."
- G. Provide factory test reports in accordance with Part 2 of this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Whenever possible, motor and driven equipment shall be shipped complete as an entire assembly.
- B. Inspect equipment immediately upon arrival and any irregularities or damage shall be reported to the Manufacturer/Supplier immediately.
- C. Store in accordance with manufacturer's recommendations.

1.7 IDENTIFICATION

- A. Nameplates: All motors shall have a stainless steel nameplate attached with stainless steel fasteners on the motor. The nameplate shall be stamped with nameplate markings listed in NEMA MG 1 20.60, plus the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Manufacturer
2. Model Number
3. Serial Number
4. Nominal efficiency
5. Minimum efficiency
6. Temperature Rise
7. Bearing manufacturer's name and catalog number

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Motor requirements apply to factory-installed motors except as follows:
 1. Different ratings, performance, or characteristics for motor are specified in another Section.
 2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
- C. Contractor assumes responsibility for the correct direction of rotation required by the equipment drives. In the event of damage due to reverse rotation, the equipment shall be repaired or replaced at no charge to the Owner.
- D. Motor Bearings: Motor bearings shall be specifically designed for the drive application, and shall be approved by the Engineer. Bearings shall have a minimum bearing life of B-10 or L-10 as defined by the AFBMA. Bearings shall be designed to carry the total hydraulic and static thrust developed by the driven load. Bearings shall be grease or oil lubricated. Oil lubricated motors shall be fitted with gravity-feed oil reservoirs. Grease lubricated bearings shall be regreasable (not sealed) and shall be supplied with grease fittings and drain plugs. Medium voltage and variable frequency controlled motor bearings shall be electrically isolated from the shaft on at least one end to prevent transmission of electric current. Current drain brushes shall be fitted where it is necessary to divert the flow of electrical current from bearings. Bearings, housing and brackets shall be constructed to permit access, removal and replacement of the bearings without disassembly of the motor.
- E. Rotor: The rotor shall be dynamically and statically balanced. Assembled motor shall be tested at the factory in accordance with latest applicable NEMA MG 1 and IEEE 112 methods of testing, and balanced at no more than 0.001 inches total peak-to-peak deflection on the bearing housing and the shaft. Overall vibration readings, including all vibration frequencies, shall be taken and recorded at no load and design speed.
- F. Terminal Box: Motors shall have a watertight cable terminal box. Terminal box shall be oversized, diagonally split, and rotatable in 90o increments to allow conduit and cable entry from top, bottom and sides.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- G. Motor Leads: Motor leads shall be a minimum of 6 inches in length. All motor leads shall be extended from the conduit box. Motors rated over 200 HP or over 600V shall have insulated tin plated copper busbar terminals with bolt holes for compression wire lugs.
- H. Drains and Breathers: Provide drain(s) in the bottom of the motor at the lowest point(s). Enclosed motors shall be fitted with breathers.
- I. Screens: Provide stainless steel screens at motor ventilation openings.
- J. Motor Shaft: The motor shaft shall be ASTM A322 GR140 (AISI 4140) steel and shall be sized to accommodate the required power and torque. Provide shaft end with keyway for connection to coupling with the pump shaft. Coordinate shaft design requirements with driven load.
- K. Stainless Steel Hardware: Provide corrosion resistant hardware for motor components including grease fittings, plugs, nuts, bolts, washers and screws.
- L. Motor Casing and Coating: Housings shall be degreased, primed and painted both inside and outside with a rust inhibitive primer and corrosion resistant polyester paint. Painting shall be performed prior to installing the motor stator windings. The primer and paint materials selected shall be suitable for the environment encountered, both inside and outside of the casing.
- M. Shaft Grounding Ring: Each motor shaft shall be provided with a Shaft Grounding Ring (SGR) that will provide a reliable low resistance path from the motor shaft to the motor frame to prevent the buildup of destructive high frequency shaft currents that are created by the Pulse Width Modulation of the Variable Frequency Drive units. The SGR shall encircle the shaft and shall be designed to promote efficient discharge of the high frequency shaft currents to the motor frame. The motor frame shall be inherently grounded by design.
- N. Power Factor Correction Capacitors: Provide motor power factor correction capacitors for all motors rated 600V or less (except variable frequency controlled motors) with less than 90% uncorrected power factor. Motor power factor correction capacitors shall be sized as recommended by the motor manufacturer to correct the motor power factor to over 90%. Motor power factor correction capacitor sizes shall not be larger than the maximum size recommended by the motor manufacturer. Enclosure type shall be NEMA 12. Capacitors shall be dry film type with fuses and discharge resistors.
- O. Composite Factor: Each motor, 1 HP or larger, or motor driven equipment, 1 HP or larger shall have a composite power factor (PF) rating of ninety (90) percent to 100 percent when the driven equipment is operating at the design duty defined on the drawings. Power factor correction devices shall be provided to meet the stated criteria.
- P. Devices such as capacitors, or equipment such as solid state power factor controllers, shall be provided as part of the motor or item of motor driven equipment when required for power factor correction. Devices shall be completely mounted and wired to the motor terminal except as follows:
 - 1. For a motor or motor driven equipment requiring other than across-the-line starting, power factor (PF) correcting capacitors, or other equipment, shall be

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

connected to motor terminals via a contactor (controller) with a 120 volt alternating current (VAC) coil. The 120 volt alternating current (VAC) coil shall be energized via an auxiliary contact on the contactor (controller) used to establish the "run" operating mode for the motor driven equipment.

2. For two (2) speed motors, power factor (PF) shall be corrected at each speed via separate groups of capacitors or other equipment for each speed. Each group of PF correcting components shall be connected to motor terminals via a separate contactor (controller) with a 120 volt alternating current (VAC) coil. Each 120 volt alternating current (VAC) coil shall be energized via an auxiliary contact on the contactor or controller used to establish "run" operations at each speed.

- Q. Locked rotor kVA shall not exceed NEMA Code Letter F for motors over 10 horsepower.
- R. Motors shall have the following enclosure types in accordance with NEMA MG 1:
1. For clean dry indoor areas: open drip proof (ODP) fully-guarded
 2. For outdoor locations: totally-enclosed fan-cooled for small and medium machines, weather protected type II for large machines
 3. Explosion-proof machines shall be provided for hazardous areas classified in accordance with NFPA 70 (National Electrical Code). Explosion proof motors shall be NRTL-listed for the hazardous area classification.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Motors Smaller Than ½ HP: Single phase.
- D. Frequency Rating: 60 Hz.
- E. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

2.3 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. Check operating motors for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.
- B. Report unusual conditions.
- C. Correct deficiencies.

END OF SECTION 220513

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
- B. Related Requirements:
 - 1. Division 07 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Sleeves without Waterstop:
 - 1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
 - 2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
 - 3. Steel Sheet Sleeves: ASTM A653/A653M, 24 gauge (0.6 mm) minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
 - 4. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange.
- B. Sleeves with Waterstop:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc
 - b. CALPICO, Inc

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. CCI Piping Systems
 - d. Flexicraft Industries
 - e. GPT; an EnPro Industries company
 - f. The Metraflex Company
 - 2. Description: Manufactured galvanized-steel, sleeve-type, waterstop assembly, made for imbedding in concrete slab or wall.
- C. Stack-Sleeve Fittings:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company
 - c. Zurn Industries
- D. Description: Manufactured, galvanized or cast-iron sleeve with integral cast flashing flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
- E. Underdeck Clamp: For roof installations, include clamping ring with setscrews.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Advance Products & Systems, Inc
 - 2. CALPICO, Inc
 - 3. GPT; an EnPro Industries company
 - 4. Metraflex Company (The)
 - 5. Proco Products, Inc
 - 6. Trumbull Industries
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
- 1. Hydrostatic seal: 20 psig.
- C. Sealing Elements: **[EPDM-rubber]** **[High-temperature-silicone]** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
- D. Pressure Plates: Heavy-duty glass-reinforced plastic (GRP/FRP).
- E. Connecting Bolts and Nuts: Carbon steel, with zinc coating. ASTM B633 of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000 psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

- A. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.
 - 1. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone Foam Sealant: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Fasten sleeves securely in floors and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials from being forced into space between pipe and sleeve during construction
- C. 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.
- D. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. 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.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- E. 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 minimum 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- F. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout to seal the space around outside of sleeve-seal fittings.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves or sleeve-seal fittings.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves or sleeve-seal fittings.
 - 2. Concrete Slabs-on-Grade:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Interior Partitions:
- a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

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. Escutcheons.
 - 2. Floor plates.

1.3 DEFINITIONS

- A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BrassCraft Manufacturing Co.; a Masco company
 - 2. Dearborn Brass
 - 3. Keeney Manufacturing Company (The)
 - 4. Mid-America Fittings, Inc.
 - 5. ProFlo; a Ferguson Enterprises, Inc. brand

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel or brass with polished, chrome-plated finish and spring-clip fasteners.
- E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for exposed piping penetrations of finished walls, ceilings, and floors.
- B. Install escutcheons on bare piping to be compatible with pipe material:
 - 1. Copper Piping: Brass
 - 2. Ferrous Piping: Steel.
 - 3. Plastic Piping: Steel.
 - 4. Stainless Steel Piping: Stainless Steel.
- C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping and Relocated Existing Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece or split-plate, with concealed hinge with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
 - 2. Escutcheons for Existing Piping to Remain:
 - a. Chrome-Plated Piping: Split-plate with concealed hinge with polished, chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.
 - f. Bare Piping in Equipment Rooms: Split-plate with concealed hinge with polished, chrome-plated finish.
- D. Install floor plates for exposed piping penetrations of floors in finished areas with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping and Relocated Existing Piping: One-piece, floor plate.
 - 2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

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. Bimetallic-actuated thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.
 - 5. Test plugs.
- B. Related Requirements:
 - 1. Section 221119 "Domestic Water Piping Specialties" for domestic water flow meters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Weiss SF3VBM or comparable product by one of the following:
 - 1. Ashcroft, Inc.
 - 2. Terice, H. O. Co.
 - 3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 4. Weiss Instruments, Inc.
 - 5. Weksler Glass Thermometer Corp.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and hermetically sealed type; 304 stainless steel with 3-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable, bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; welded stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

2.2 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 3. Material for Use with Copper Tubing: Copper-nickel.
 - 4. Material for Use with Steel Piping: Corrosion-resistant steel.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
 - 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
 - 8. Bore: Diameter required to match thermometer bulb or stem.
 - 9. Insertion Length: Length required to match thermometer bulb or stem.
 - 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 DIAL-TYPE PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ashcroft Type 1010 or comparable product by one of the following:
 - a. Ashcroft, Inc.
 - b. Terice, H. O. Co.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
- d. Weiss Instruments, Inc.
- 2. Standard: ASME B40.100.
- 3. Accuracy: Grade 1A, plus or minus 1 percent of middle half of scale range.
- 4. Case: Open-front, pressure relief type; black epoxy painted aluminum; 4-1/2-inch nominal diameter.
- 5. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- 6. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- 7. Movement: Mechanical, with link to pressure element and connection to pointer.
- 8. Dial: Nonreflective aluminum, white background with permanently etched black scale markings graduated in psi.
- 9. Pointer: Dark-colored metal, micrometer adjustable.
- 10. Window: Glass.
- 11. Ring: Threaded reinforced black metal.
- 12. Connection Location: Lower or back.
- 13. Mounting: Stem.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ashcroft, Inc.
 - 2. Trerice, H. O. Co.
 - 3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 4. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each water heater.
 - 3. Inlets and outlets of each domestic water heat exchanger.
 - 4. Inlet and outlet of each domestic hot-water storage tank.
- J. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.
- K. Install isolation valves on both sides of flowmeters to allow servicing.
- L. Install wells in plumbing piping for automatic temperature control sensors.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.4 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 100 psi.
- B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION 220519

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

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. Ball valves.
 - 2. Check valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 Annex G and NSF 372 for products that come in contact with potable water.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
- B. Use the following precautions during storage:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles, stems or handwheels as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- C. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
 2. ASME B16.1 for flanges on iron valves.
 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 4. ASME B16.18 for solder-joint connections.
 5. ASME B31.9 for building services piping valves.
- D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Bypass and Drain Connections: MSS SP-45.
- I. Ball Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4.
- J. Valves in Insulated Piping:
1. Include 2-inch stem extensions with protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 2. For valves used for throttling or balancing, include memory stops that are fully adjustable after insulation is applied.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.2 BALL VALVES

- A. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions
 - c. Hammond Valve
 - d. Milwaukee Valve Company
 - e. NIBCO INC.
 - f. Viega
 - g. WATTS
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Lead free brass.
 - e. Ends: Threaded or soldered.
 - 1) Press joint ends shall be acceptable only if also approved for the associated piping system connections.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.

2.3 CHECK VALVES

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Crane; a Crane brand
 - c. Hammond Valve
 - d. Jenkins Valves; a Crane brand
 - e. Milwaukee Valve Company
 - f. NIBCO INC.
 - g. Stockham; a Crane brand
 - h. WATTS
 - 2. Description:
 - 3. Standard: MSS SP-80, Type 3.
 - 4. CWP Rating: 200 psig.
 - 5. Body Design: Horizontal flow.
 - 6. Body Material: ASTM B62, bronze or ASTM B806 copper silicon alloy.
 - 7. Ends: Threaded or soldered. See valve schedule articles.
 - 8. Disc: Bronze.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Valves shall be provided where indicated on the drawings and as herein specified.
- B. Install shut-off valves in piping where shown and where listed below:
 - 1. To isolate all items of equipment.
- C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above center of pipe.
- F. Install valves in position to allow for handwheel operation, full stem movement and stuffing maintenance.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.
- H. Install valve tags.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. NPS 2 and Smaller: Threaded or soldered.

3.5 DOMESTIC WATER VALVE SCHEDULE

- A. Ball Valves:
 - 1. Pipe NPS 3 and Smaller: Brass ball valves, two-piece with full port and stainless-steel trim.
 - 2. Pipe NPS 4 and Larger: Iron ball valves, Class 150 with full port.
- B. Check Valves:
 - 1. Pipe NPS 3 and Smaller: Bronze swing check valves with bronze disc, Class 125, with soldered end connections.

END OF SECTION 220523

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal hanger-shield inserts.
 - 4. Fastener systems.
 - 5. Pipe-positioning systems.
 - 6. Equipment supports.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. It shall be the responsibility of the Contractor to provide an adequate pipe hanger and support system for all pipe systems and equipment in accordance with recognized

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

engineering practices, using standard, commercially accepted pipe hangers and suspension equipment.

- B. Structural Performance: Hangers and supports for plumbing 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.
 - 3. Design seismic-restraint hangers and supports for piping and equipment.

2.2 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, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
 - 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.
- B. Copper Pipe and Tube Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL HANGER-SHIELD INSERTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Pipe Shields Inc or comparable product by one of the following:
 - 1. Carpenter & Paterson, Inc
 - 2. Clement Support Services
 - 3. ERICO International Corporation
 - 4. Insulation Components, Inc.
 - 5. National Pipe Hanger Corporation
 - 6. Pipe Shields Inc.
 - 7. Piping Technology & Products, Inc
 - 8. Rilco Manufacturing Co., Inc

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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.
- C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-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 shall cover entire circumference of pipe. Shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 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.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. MKT Fastening, LLC
 - d. Simpson Strong-Tie Co., Inc.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - d. MKT Fastening, LLC
 - 2. Indoor Applications: Zinc-coated or stainless steel.
 - 3. Outdoor Applications: Stainless steel.
- C. Per IBC and ACI 318 Appendix D, all concrete anchors within the scope of ACI 318 require approved anchors for crack concrete. Attachment devices shall have certified load test data from an independent test laboratory and shall be capable of carrying a minimum of five times the design load. The concrete anchors for the following supported items need to meet the crack concrete requirements:
 - 1. Any suspended pipe, larger than 2", regardless of material.
 - 2. All components with an I_p 1.5.
 - 3. All components required to function after a seismic event.
 - 4. Anywhere required by ASCE 7.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.6 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.8 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107/C 1107M, 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 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported operating components with a design safety factor of not less than five.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
 - 3. The use of cable ties, zip ties and/or tie wraps for attaching piping to metal trapeze pip-hanger is prohibited. Provide appropriate strut clamps, brackets and/or similar attachments to properly secure piping to trapeze pipe-hangers.
- C. Thermal Hanger-Shield Installation: Install in pipe hanger for insulated piping.
- D. 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.
- E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. 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.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. 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.
- K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. 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.
- M. Insulated Piping:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
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 2-1/2 and Larger: Include thermal hanger shield inserts of length at least as long as protective shield. Insert thickness shall be the same thickness as piping insulation. Fill interior voids with insulation that matches adjoining insulation and seal as appropriate.

N. In no case shall wire or perforated strap be used for pipe or conduit support.

3.3 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.

3.4 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 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 maximum 1-inch.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications with field-applied finish.
- D. Use hangers and supports with electro-galvanized coatings for piping and equipment that will not have field-applied finish.
- E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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 occurs.
 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 occurs.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 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 occurs and vertical adjustment is unnecessary.
 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, in addition to expansion and contraction, is required.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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 of 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

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.
- B. The International Building Code and ASCE/SEI 7 Standard apply to all work associated with the seismic installation of all new mechanical piping and equipment. Refer to Structural drawings and ASCE/SEI 7 for seismic and wind loads and additional information.

1.2 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Air-spring isolators.
 - 11. Restrained-air-spring isolators.
 - 12. Elastomeric hangers.
 - 13. Spring hangers.
 - 14. Snubbers.
 - 15. Restraints - rigid type.
 - 16. Restraints - cable type.
 - 17. Restraint accessories.
 - 18. Post-installed concrete anchors.
 - 19. Concrete inserts.

1.3 DEFINITIONS

- A. ASCE/SEI: American Society of Civil Engineers/Structural Engineering Institute.
- B. IBC: International Building Code.
- C. ICC-ES: ICC-Evaluation Service.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Include load rating for each wind-force-restraint fitting and assembly.
 - 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic- and wind-force-restraint component.
 - 4. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
 - 5. Annotate to indicate application of each product submitted and compliance with requirements.
 - 6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal:
 - 1. For each seismic-restraint and wind-load protection device, including seismic-restrained mounting, pipe-riser resilient support, snubber, seismic restraint, seismic-restraint accessory, concrete anchor and insert, and restrained isolation roof-curb rail that is required by this Section or is indicated on Drawings, submit the following:
 - a. Seismic and Wind-Load Restraint, and Vibration Isolation Base Selection: Select vibration isolators, seismic and wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
 - b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
 - c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
 - d. Seismic Design Calculations: Submit all input data and loading calculations prepared under "Seismic Design Calculations" Paragraph in "Performance Requirements" Article.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- e. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.
- f. Qualified Professional Engineer: All designated-design submittals for seismic- and wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.
- 2. Seismic- and Wind-Restraint Detail Drawing:
 - a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.
- 3. All delegated-design submittals for seismic- and wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
- 4. Product Listing, Preapproval, and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).
- 5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
- 6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Air-Spring Isolator Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.
- E. Field quality-control reports.
- F. Seismic Qualification Data: Provide special certification for designated seismic systems as indicated in ASCE/SEI 7 Paragraph 13.2.2, "Special Certification Requirements for

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

Designated Seismic Systems" for all Designated Seismic Systems identified as such on Drawings or in the Specifications.

1. Provide equipment manufacturer's written certification for each designated active mechanical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7 and AHRI 1270, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction or experience data as permitted by ASCE/SEI 7.
2. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in ASCE/SEI 7.
3. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by a licensed professional engineer.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-spring isolators and restrained-air-spring isolators to include in operation and maintenance manuals.
- B. Manufacturer's Inspection Report: Contractor shall submit factory-authorized service representative's final report indicating all restraints and isolation devices as being properly installed or requiring correction.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic- and Wind-Load-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.

1.8 COORDINATION

- A. Coordinate with vibration isolation restraint manufacturer and the structural contractor/engineer of record to locate and size structural supports underneath vibration isolated restrained equipment (e.g. roof curbs and other similar equipment).

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic and wind-load control system.
 - 1. Seismic and Wind-Load Performance: Equipment shall withstand the effects of earthquake motions and high wind events determined in accordance with ASCE/SEI 7.
- B. Seismic Design Calculations:
 - 1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to is the currently adopted edition.
 - a. Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
 - b. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
- C. Fire/Smoke Resistance: Seismic- and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- D. Component Supports:
 - 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 - 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7.

2.2 GENERAL

- A. Select vibration isolating units for the lowest operating speed of equipment, so designed that natural frequency of equipment and base mass is not less than 1.5 times the lowest operating frequency of the moving equipment, but not a multiple or harmonic of the base frequency. Furnish vibration isolation producing a uniform loading and deflection even when equipment weight is not evenly distributed, vibration isolation shall be stable during starting and stopping of equipment without excessive traverse and eccentric movement of equipment.
- B. The installed vibration isolation system for each floor or ceiling mounted item of equipment shall have a maximum lateral motion under equipment start up and shut down conditions of 1/4 inch. Motions in excess shall be restrained by approved spring type mounting.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. The type of isolation, base, and minimum static deflection shall be as required for each specific equipment application, but not less than that specified herein when supported on a solid concrete structural slab having a thickness of not less than four (4) inches.
 - 1. Should vibration isolators installed for the equipment prove inadequate to prevent transmission of equipment vibrations to the building structure or limit equipment vibration originated noise in the building spaces to acceptable levels, the isolators shall be replaced with units having the largest deflection that can be practicably installed.
- D. All springs installed outdoors shall be cadmium-plated, zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
- E. All isolators installed outdoors shall have base plates with bolt holes for fastening the isolators to the support members.

2.3 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. California Dynamics Corporation
 - b. Isolation Technology, Inc
 - c. Kinetics Noise Control, Inc.
 - d. Mason Industries, Inc.
 - e. The VMC Group
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation Co., Inc.
 - h. Vibration Mountings & Controls/Korfund.
 - i. Vibro-Acoustics, Inc.
 - 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 3. Size: Factory or field cut to match requirements of supported equipment.
 - 4. Pad Material: Oil and water resistant with elastomeric properties.
 - 5. Surface Pattern: Waffle pattern.
 - 6. Infused nonwoven cotton or synthetic fibers.
 - 7. Load-bearing metal plates adhered to pads.

2.4 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene.
 - 1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 - 2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.5 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.
 - 1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.6 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. California Dynamics Corporation
 - b. Isolation Technology, Inc
 - c. Kinetics Noise Control, Inc.
 - d. Mason Industries, Inc.
 - e. The VMC Group
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation Co., Inc.
 - h. Vibration Mountings & Controls/Korfund.
 - i. Vibro-Acoustics, Inc.
 - 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod (where required).
 - 9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.7 RESTRAINTS - RIGID TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. California Dynamics Corporation
 - 3. Hilti, Inc.
 - 4. Mason Industries, Inc.
 - 5. Unistrut; Part of Atkore International

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.8 RESTRAINTS - CABLE TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Gripple Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Novia; A Division of C&P
 - 5. Vibration & Seismic Technologies, LLC
 - 6. Vibration Mountings & Controls, Inc.
- B. Seismic-Restraint Cables: ASTM A603 galvanized-steel or ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.
- C. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.9 RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Novia; A Division of C&P
 - 5. TOLCO
 - 6. Vibration & Seismic Technologies, LLC
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.10 POST-INSTALLED CONCRETE ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
 - 5. Unistrut; Atkore International.
- B. Mechanical Anchor Bolts:
 - 1. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
- C. Adhesive Anchor Bolts:
 - 1. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
- D. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7, Ch. 13.
 - 1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - 2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

2.11 CONCRETE INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
 - 5. Unistrut; Atkore International.
- B. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC408 testing.
- C. Comply with ANSI/MSS SP-58.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 INSTALLATION OF VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICES

- A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
- B. Provide seismic-restraint and wind-load control devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- C. Housekeeping Pads:
 - 1. All floor-mounted equipment shall be set on concrete housekeeping pads designed by the seismic engineer to meet the specific seismic requirements of each piece of floor mounted equipment.
 - 2. Housekeeping pads shall rest on a structural floor and be constructed per the details provided by the seismic engineer.
 - 3. Housekeeping pad shall be constructed as one continuous monolithic pour. Forms shall be constructed to allow removal after concrete pour without prying against pad.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- E. Installation of vibration isolators, wind-load restraints, must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- F. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- G. Equipment Restraints:
 - 1. Install seismic snubbers on equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint, and wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- H. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- I. Install seismic- and wind-load-restraint cables so they do not bend across edges of adjacent equipment or building structure.
- J. Equipment Bases:
 - 1. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.
 - a. Cast-in-place concrete materials and placement requirements are specified in Division 3.
 - 2. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - b. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - f. Cast-in-place concrete materials and placement requirements are specified in Division 3.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- K. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- L. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- M. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- N. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- O. Mechanical Anchor Bolts:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Provide flexible connections in piping systems where they cross structural seismic joints, expansion joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in other sections for piping flexible connections.

3.5 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT BASES

- A. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Coordinate dimensions of steel equipment rails and bases, concrete inertia bases, and restrained isolation roof-curb rails with requirements of isolated equipment specified in this and other Sections. Where dimensions of these bases are indicated on Drawings, dimensions may require adjustment to accommodate actual isolated equipment.

3.6 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Perform tests and inspections with the assistance of a factory-authorized service representative.
 - 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 4. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 5. Test no fewer than four of each type and size of installed anchors and fasteners selected by Architect.
 - 6. Test to 90 percent of rated proof load of device.
 - 7. Measure isolator restraint clearance.
 - 8. Measure isolator deflection.
 - 9. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Units will be considered defective if they do not pass tests and inspections.
- E. Prepare testing agency test and inspection reports.
- F. Manufacturer's Inspection:
 - 1. A representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation errors, improperly selected isolation or restraint devices, or other faults that could affect the performance of the system.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Contractor shall submit manufacturer's representative's final report indicating all isolation as being properly installed or requiring correction. If corrections are required, include steps to be taken to properly complete the isolation work.

3.8 VIBRATION ISOLATION AND SEISMIC-RESTRAINT SCHEDULE

- A. Suspended Inline Pumps:
 1. Isolation Type: Spring Hanger
 2. Deflection: 0.25"
- B. First Four (4) Pipe Hangers near Isolated Equipment:
 1. Isolation Type: Spring Hanger
 2. Deflection:
 - a. Piping 3-inches and smaller: 0.75"
 - b. Piping 4-inches to 6-inches: 1.5"
 - c. Piping Larger than 6-inches: 2.5"

END OF SECTION 220548

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.
 - 4. Underground Warning Labels.
 - 5. Warning tags.

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.
- C. Pipe Label Schedule: Include a listing of all piping to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals. Include Service Abbreviation, Number Sequence, Valve Location and Valve Function.

1.4 QUALITY ASSURANCE

- A. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. ANSI / ASME A13.1: "Scheme for the Identification of Piping Systems"
 - 2. ANSI Z535.1: "Safety Color Code"
 - 3. NFPA-99C; CGA C-9-2002 "Standard Industry Color Coding Recommendations for Medical Gases."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP
 - d. Craftmark Pipe Markers
 - e. Kolbi Pipe Marker Co.
 - f. LEM Products Inc.
 - g. Seton Identification Products
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 3. Letter and Background Color: As indicated for specific application under Part 3.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 4 by 2-1/2 inch.
 - 6. Minimum Letter Size: 3/4 inch.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws, or double face adhesive.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number as indicated on the mechanical drawings and schedules.

2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc.
 - 3. Carlton Industries, LP
 - 4. Craftmark Pipe Markers
 - 5. Kolbi Pipe Marker Co.
 - 6. LEM Products Inc.
 - 7. Seton Identification Products
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic
 - 1. For Pipes With an Overall Pipe Diameter of 8" or less: Formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
 - 2. For Pipes With an Overall Pipe Diameter Larger Than 8": Formed to partially cover circumference of pipe and to attach to pipe with no less than two nylon strap-on fasteners.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Self-Adhesive Pipe Labels:
 - 1. For Pipes With an Overall Pipe Diameter of 3/4" or less: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.3 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc.
 - 3. Carlton Industries, LP
 - 4. Craftmark Pipe Markers
 - 5. Kolbi Pipe Marker Co.
 - 6. LEM Products Inc.
 - 7. Seton Identification Products
- B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 1-1/2 diameter, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware. If necessary, to accommodate longer abbreviations or number sequences increase tag size to 2" in diameter.
 - 2. Fasteners: Brass wire-link chain or beaded chain.
- C. Valve Markers: Engraved phenolic plastic nameplates with 3/4-inch white surface and 1/4-inch tall black lettering.
 - 1. Fasteners: Epoxy.
- D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.4 UNDERGROUND PIPE WARNING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Carlton Industries, LP
4. Craftmark Pipe Markers
5. Kolbi Pipe Marker Co.
6. LEM Products Inc.
7. Seton Identification Products

- B. Description: Preprinted detectable underground tape of B-721 metal detectable polyester material with subsurface graphics to seal the legend from acids, alkalis and other destructive soil substances.
1. Size: Minimum 5 mils thick, 4 inches wide with minimum tensile strength of 120 lbs.
 2. Nomenclature: Utilize manufactures standard legends to identify underground piping. Provide a continuous printed message similar to "Caution Water Line Buried Below"
 3. Color: Utilize manufactures standard colors.

2.5 WARNING TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation
 2. Brimar Industries, Inc.
 3. Carlton Industries, LP
 4. Craftmark Pipe Markers
 5. Kolbi Pipe Marker Co.
 6. LEM Products Inc.
 7. Seton Identification Products
- B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Safety yellow background with black lettering.

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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.2 GENERAL INSTALLATION REQUIREMENTS

- 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.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of plumbing equipment.
- B. Locate equipment labels where accessible and visible.
- C. For equipment located above the ceiling, in addition to a label on the equipment, equipment markers are to be permanently affixed to the ceiling grid framing as near to the item as possible using epoxy glue. Where hard ceilings are used, the label is to be affixed to the frame of the access panel for the unit.

3.4 PIPE COLOR CODING

- A. Paint exposed and insulated piping in finished areas and mechanical rooms.
 - 1. Finished Areas: Color shall be the same as the adjacent surface. Color by Architect.
 - 2. Mechanical Rooms: Color shall be the same as the pipe label background color.
 - 3. 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.
 - 4. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Exterior non-insulated piping shall be painted with two coats of rust inhibitive paint. Colors shall be approved by the Owner after a sample is provided for each service. Do not paint aluminum jackets.
- C. Do not paint exposed copper piping or galvanized piping.
- D. Do not paint aluminum or stainless-steel jackets.
- E. Painting of piping is specified in Division 09.

3.5 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, crawl spaces and plenums; and exterior exposed locations as follows:
 - 1. Spaced at maximum intervals of 20 feet along each straight run.
 - 2. Near each valve and control device.
 - 3. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Near each change in direction.
 5. Above and below every floor penetration and on either side of every wall penetration.
 6. At least one pipe marker per pipe in every room.
 7. At access doors, manholes, and similar access points that permit view of concealed piping.
 8. Near major equipment items and other points of origination and termination.
 9. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Vertical Piping: Provide strip of adhesive on the inside of pretensioned pipe labels to further secure the marker in a permanent position.
- D. Pipe Label Color Schedule:
1. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.
 - c. Designation: COLD WATER, HOT WATER, HOT WATER RECIRC.
 2. Sanitary Waste and Vent Piping:
 - a. Background Color: Safety black.
 - b. Letter Color: White.
 - c. Designation: SANITARY DRAIN, VENT.
 3. Natural Gas:
 - a. Background Color: Safety Yellow.
 - b. Letter Color: Black.
 - c. Designation: NATURAL GAS.

3.6 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve Tags for Shutoff Valves in Medical Gas and Vacuum Systems: Tag shall contain the name or chemical symbol of the specific system, the room served, and a caution to not close or open the valve except in emergency. The operating pressure of the gas system shall be included on the tag if the system operates at pressures other than the standard gauge pressure of 50psi to 55 psi, 15 in to 30 in HgV (Vacuum) or 160-185 psi (Nitrogen or Instrument Air).
- C. Ceiling valve markers shall be provided for valves above ceilings. Attach valve marker to ceiling grid directly below the valve.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.7 UNDERGROUND PIPE WARNING

- A. Provide continuous underground pipe marking tape above all plumbing pipes buried beneath the ground.
- B. Provide a continuous length of tape 6" below the finished earth surface directly above the buried pipe.
- C. Provide a second continuous length of tape 12" above the top of the buried pipe if the top of the pipe is lower than 36" from the top of the finished earth surface.
- D. If tape cannot be continuous then it must overlap by ten feet at any end.

3.8 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220593 - TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

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. TAB of plumbing equipment:
 - a. Domestic hot-water in-line circulation pumps.
 - 2. Pipe-leakage test verification.
 - 3. Testing, adjusting, and balancing of existing plumbing systems and equipment.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Submit the Contract Documents review report as specified in Part 3.
- C. System Readiness Checklists: Submit system readiness checklists as specified in "Preparation" Article.
- D. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. Certified TAB reports.
- F. Sample report forms.
- G. 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.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE 188 Compliance: Comply with balancing and report requirements, Section 8.3 "Balancing."
- D. Code and Authorities Having Jurisdiction Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, BAS provider, and other mechanics to operate plumbing systems and equipment to support and assist TAB activities.
- B. Coordinate efforts with the project Commissioning Agent. Refer to commissioning specifications for additional information.
- C. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. 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.

1.8 WARRANTY

- A. Performance Warranty:
 - 1. If AABC standards are used, provide a warranty on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
 - 2. If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
- B. Warranty includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, available TAB specialists that may be engaged include, but are not limited to, the following:
 - 1. Carolina Air & Water Balancing Company, Inc.
 - 2. Hall Technology, Inc.
 - 3. KLG Jones, LLC.
 - 4. Palmetto Air & Water Balance, Inc.

3.2 EXAMINATION

- A. 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.
- B. Examine installed systems for balancing valves and fittings. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine approved submittals for plumbing systems and equipment.
- D. Examine design data, including plumbing system descriptions.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. Examine equipment performance data, including pump curves.
 - 1. Relate performance data to Project conditions and requirements, including pump system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate pump system-effect factors to reduce performance ratings of plumbing equipment when installed under conditions different from the conditions used to rate equipment performance. Compare results with the design data and installed conditions.
- F. Examine system and equipment installations.
- G. Examine system pumps to ensure absence of entrained air in the suction piping.
- H. Examine operating safety interlocks and controls on plumbing equipment.
- I. 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.

3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Strategies and step-by-step procedures for balancing the systems.
 - 2. Instrumentation to be used.
 - 3. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of plumbing systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Domestic Water System:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed in accordance with applicable code and authority having jurisdiction.
 - b. Water heaters are installed and functioning.
 - c. Piping is complete and all points of outlet are installed.
 - d. Water treatment is complete.
 - e. Systems are flushed, filled, and air purged.
 - f. Strainers are clean.
 - g. Shutoff and balance valves are 100 percent open.
 - h. Booster and hot-water circulating pumps are operational and proper rotation is verified.
 - i. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in ASHRAE 111 and in this Section.
- B. Cut insulation, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Where holes for probes are required in piping or equipment, install pressure and temperature test plugs to seal systems.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 220700 "Plumbing Insulation."
- C. Mark equipment and balancing devices, including valve position indicators 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.

3.5 GENERAL PROCEDURES FOR PLUMBING EQUIPMENT

- A. Test, adjust, and balance plumbing equipment indicated on Drawings, including, but not limited to, the following:
1. Domestic water in-line pumps.

3.6 PROCEDURES FOR DOMESTIC HOT-WATER CIRCULATING INLINE PUMP

- A. Balance system with manual or automatic balancing valves by setting at design flow.
1. Measure flow in main and branch pipes.
 2. Adjust main and branch balance valves for design flow.
 3. Re-measure each main and branch after all have been adjusted.
- B. Adjust pump to deliver total design flow.
1. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gauge heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
 2. Monitor motor performance during procedures, and do not operate motor in an overloaded condition.
 3. Mark final settings and verify that all memory stops have been set.
 4. Verify final system conditions as follows:
 - a. Re-measure and confirm that total flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
 - c. Mark final settings.

3.7 TOLERANCES

- A. Set plumbing system's flow rates within the following tolerances:
1. Domestic Hot-Water Rate: Plus 10 percent.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.8 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.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump 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 specialist.
 - 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. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 14. Test conditions for pump performance forms.
- D. System Diagrams: Include schematic layouts of distribution systems. Present each system with single-line diagram and include the following:
 - 1. Flow rates.
 - 2. Pipe and valve sizes and locations.
 - 3. Balancing stations.
 - 4. Position of balancing devices.
- E. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves, and include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water-pressure differential in feet of head or psig.
 - h. Pump speed.
 - i. Impeller diameter in inches.
 - j. Motor make and frame size.
 - k. Motor horsepower and rpm.
 - l. Voltage at each connection.
 - m. Amperage for each phase.
 - n. Full-load amperage and service factor.
 - o. Seal type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- F. Instrument Calibration Reports:
- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.
- ### 3.9 VERIFICATION OF TAB REPORT
- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of the Architect, Owner's representative, or Commissioning authority.
 - B. Architect, Owner's representative, or Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 - C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 - D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
- F. Prepare test and inspection reports.

END OF SECTION 220593

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 220700 - PLUMBING INSULATION

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 insulation for the following plumbing services:
 - 1. Plumbing equipment.
 - 2. Plumbing piping.

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).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail removable insulation at equipment connections and access panels.
 - 7. Detail application of field-applied jackets.
 - 8. Detail application at linkages of control devices.
 - 9. Detail field application for each equipment type.
- C. Samples:
 - 1. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

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

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.

B. Comply with the following applicable codes and standards and other requirements specified for miscellaneous components:

1. ICC - International Energy Conservation Code (ICC-IECC)
2. ANSI/ASHRAE/IES Standard 90.1-2016 -- Energy Standard for Buildings Except Low-Rise Residential Buildings
3. Supply and Drain Protective Shielding Guards: ICC A117.1.

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.

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 PART 3 - EXECUTION articles for where insulating materials shall be applied.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC
 - c. K-Flex USA
- 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 equipment applications, provide insulation with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Manson Insulation Inc.
 - e. Owens Corning
- H. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company
 - b. Knauf Insulation
 - c. Manson Insulation Inc.
 - d. Owens Corning
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. CertainTeed Corporation
- b. Johns Manville; a Berkshire Hathaway company
- c. Knauf Insulation
- d. Manson Insulation Inc.
- e. Owens Corning

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. 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. For indoor applications, use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aeroflex USA, Inc.
 - 2. Armacell LLC
 - 3. Childers Brand; H. B. Fuller Construction Products
 - 4. Dow Corning Corporation
 - 5. Eagle Bridges - Marathon Industries
 - 6. Foster Brand; H. B. Fuller Construction Products.
 - 7. Johns Manville; a Berkshire Hathaway company
 - 8. K-Flex USA
 - 9. P.I.C. Plastics, Inc.
 - 10. Mon-Eco Industries, Inc.
 - 11. Speedline Corporation
 - 12. Vimasco Corporation.
- D. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- F. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. For indoor applications, use mastics that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Childers Brand; H. B. Fuller Construction Products
 - 2. Eagle Bridges - Marathon Industries
 - 3. Foster Brand; H. B. Fuller Construction Products.
 - 4. Knauf Insulation
 - 5. Mon-Eco Industries, Inc.
 - 6. Vimasco Corporation
- D. 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.
 - 4. Color: White.

2.5 SEALANTS

- A. Use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Childers Brand; H. B. Fuller Construction Products
 - 2. Eagle Bridges - Marathon Industries
 - 3. Foster Brand; H. B. Fuller Construction Products.
 - 4. Knauf Insulation
 - 5. Mon-Eco Industries, Inc.
 - 6. Pittsburgh Corning Corporation
 - 7. Vimasco Corporation
- C. ASJ Flashing Sealants 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.

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.8 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
 - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- 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.
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, 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.
 - 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. Self-Sticking-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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 - 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum 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.
 - 7. 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: 0.062-inch soft-annealed, stainless 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 and equipment 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.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
 - 1. For exterior, above-grade piping: Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - a. 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.
 - b. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. 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 equipment and 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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.

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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. 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.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. 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 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF PIPE INSULATION

- 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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, 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 or required for maintenance. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.
- E. Provide latex-based, UV resistant protective coating for outdoor applications.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Install preformed 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 mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD QUALITY CONTROL

- A. If workmanship is of questionable quality, the contractor shall perform tests and inspections as directed by the Architect.
- B. Tests and Inspections:
1. Inspect field insulated equipment, pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 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. Drainage piping located in crawl spaces.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch.
 2. NPS 1-1/4 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch.
 2. NPS 1-1/4 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Domestic Potable Chilled Water (Drinking Fountains):
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.
- D. For piping smaller than 1 1/2 inches and located in partitions within conditioned spaces, reduction of the scheduled thickness by 1 inch shall be permitted, but not to a thickness less than 1 inch.

END OF SECTION 220700

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 221116 - DOMESTIC WATER PIPING

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. Domestic water piping.
 - 2. Non-potable gray-water piping.
- B. Contractor shall perform all work within the building and to a point five (5) feet from the building wall, unless otherwise noted.
 - 1. Contractor shall coordinate with site water services provided under another Division.
 - 2. The contractor shall make the final connection of the building water service to the site water service.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Pipes, tubes, fittings, and specialties for each type of piping.
 - 2. Joining materials.
 - 3. Encasement for piping.
 - 4. Transition fittings.
 - 5. Dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping: 125 psig unless otherwise indicated.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.2 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF 372 for low lead.
- D. All pipe and fittings shall be from a United States domestic manufacturer.

2.3 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint.
- G. Copper Press Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Elkhart Products Corporation
 - c. Mueller Industries, Inc.
 - d. NIBCO INC.
 - e. Viega LLC
 - 2. Description:
 - a. Cast- or wrought-copper press-connect fitting complying with material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117.
 - b. Sealing elements for press fittings shall be factory installed EPDM.
 - c. Press end fittings shall have technology to allow identification of an unpressed fitting.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. All fittings in contact with drinking water shall be listed by a third party agency to NSF/ANSI 61 and 372.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch minimum thickness.
- C. Form: Tube.
- D. Color: Black or natural.

2.6 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
 - 4. Description:
 - a. CPVC one-piece fitting with manufacturer's equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket end.

2.7 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 shall not be used. In lieu of dielectric union, use an approved brass fitting.
- C. Dielectric Flanges:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. WATTS
 - b. Wilkins
 - c. Zurn Industries, LLC
 2. Standard: ASSE 1079.
 3. Factory-fabricated, bolted, companion-flange assembly.
 4. Pressure Rating: 150 psig minimum at 180 deg F.
 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc
 - b. Calpico, Inc
 - c. Central Plastics Company
 - d. Pipeline Seal and Insulator, Inc
 2. 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 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 STORAGE AND PROTECTION

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
- C. Store piping on a flat surface to prevent unwanted deformation.

3.3 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Examine roughing-in for piping to verify actual locations of piping connections before equipment and fixture installation.
- C. Examine walls, floors and roofs for suitable conditions where piping will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- H. Install seismic restraints on piping.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. 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.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.
- R. Install thermostats in hot-water circulation piping.
- S. Install thermometers on inlet and outlet piping from each water heater.
- T. Install sleeves for piping penetrations of interior walls, ceilings, and floors.
 - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install sleeve seals for piping penetrations of exterior concrete walls and slabs.
 - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install escutcheons for exposed piping penetrations of finished walls, ceilings, and floors.
 - 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.5 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 pipes, tubes, and fittings before assembly.
- C. 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.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Press Fit Joints for Copper Tubing: Press connections shall be made in accordance with the manufacturer's installation instructions. Clean end of tube. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.6 INSTALLATION OF TRANSITION FITTINGS

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.
- D. Transition Fittings in Aboveground Gray-Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

3.7 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use approved brass fitting.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.8 INSTALLATION OF VALVES

- A. General valve installation requirements are specified in Section 220523, "General Duty Valves for Plumbing Piping."

3.9 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for piping and tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Support horizontal piping within 12 inches of each fitting.
- E. Support vertical runs of piping and tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.10 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.11 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections in the presence of the Owner, Architect or his representative:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least two days before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
 - B. Water piping will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.
 - D. Provide minimum 48 hours notice prior to testing to allow the Architect, Engineer, Commissioning Agent, Owner or his representative the opportunity to attend.
 - E. Tests shall be conducted and written report of testing submitted before any insulation is installed. Insulation installed prior to tests shall be removed.
- 3.13 ADJUSTING
- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.14 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system with water/free chlorine solution with at least 50 ppm of chlorine. Isolate with valves and test the residual to verify that the chlorine levels are present at the fixtures or valve sections. Allow to stand for 24 hours.
 - 2) Fill system with water/free chlorine solution with at least 200 ppm of chlorine. Isolate with valves and test the residual to verify that the chlorine levels are present at the fixtures or valve sections. Allow to stand for 12 hours.
 - c. If the chlorine residual is less than 10 ppm after the standing time, repeat the entire procedure above.
 - d. If the chlorine residual is greater than 10 ppm, flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - e. Repeat procedures if biological examination shows contamination.
 - f. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.15 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water and building-service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- D. Under-building-slab, trap-seal primer piping shall be one the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
 2. Hard copper tube, ASTM B 88, Type L; copper press fittings; and press joints.
- F. Aboveground, trap-seal primer piping shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
 2. Hard copper tube, ASTM B 88, Type L; copper press fittings; and press joints.

3.16 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty:
 - a. Use full-port ball valves for piping NPS 2 and smaller.
 2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

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. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated, water mixing valves.
 - 6. Strainers.
 - 7. Hose stations.
 - 8. Hose bibbs.
 - 9. Wall hydrants.
 - 10. Ground hydrants.
 - 11. Post hydrants.
 - 12. Drain valves.
 - 13. Shock absorbers/Water-hammer arresters.
 - 14. Trap-seal primer valves.
 - 15. Trap-seal primer systems.
 - 16. Specialty CPVC valves.
 - 17. Flexible connectors.
 - 18. Water meters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 Annex G.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Hose-Connection Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. MIFAB, Inc
 - c. WATTS
 - d. Zurn Industries, LLC
 - 2. Standard: ASSE 1011.
 - 3. Body: Bronze, nonremovable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 5. Finish: Rough bronze.

2.4 BALANCING VALVES

- A. Copper Alloy Calibrated Balancing Valves, ½" – 2":
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc
 - b. Flo Fab Inc
 - c. ITT Corporation
 - d. NIBCO INC.
 - e. TACO Comfort Solutions, Inc.
 - f. WATTS
 - 2. Type: Ball or Y-pattern globe valve with position indicator, two checked readout ports with drip caps and memory-setting indicator.
 - 3. Body: Brass or bronze.
 - 4. Size: As required for scheduled flow, but not larger than NPS 2.
 - 5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary Distribution, Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard Next Generation High-Low System Type TM or comparable product by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Armstrong International, Inc
 - c. Bradley Corporation
 - d. Lawler Manufacturing Company, Inc
 - e. Leonard Valve Company
 - f. POWERS; A WATTS Brand
 - g. Zurn Industries, LLC
2. Type: Exposed-mounted, thermostatically controlled, dual thermostatic water mixing valves in single piping arrangement.
3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig minimum unless otherwise indicated.
5. Material: Bronze body with corrosion-resistant interior components.
6. Temperature Control: Adjustable, dial thermometer, locking temperature regulator.
7. Inlets and Outlet: Soldered fittings, integral check valves on inlets, ball valves on outlets.
8. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, ball valves on outlets, inlet thermometers.
9. Finish: Rough bronze.
10. Pressure-Temperature:
 - a. Minimum Flow: 1.0 GPM
 - b. Maximum Pressure: 125 PSIG.
 - c. Maximum Hot Water temperature: 200°F.
 - d. Approach Temperature 5°F above set point.
 - e. Temperature Adjustment Range: 90°F -140°F
 - f. Tempered-Water Setting: 105 deg F.
11. Pipe per manufacturer's written instructions.

B. Point-of-Use, Thermostatic, Water Tempering Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard LF-170, 270 or 370 Series or comparable product by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Bradley Corporation
 - c. Lawler Manufacturing Company, Inc
 - d. Leonard Valve Company
 - e. POWERS; A WATTS Brand
 - f. WATTS
 - g. Zurn Industries, LLC
2. Standard: ASSE 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Material: Lead-free, bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable, locking (tamper resistant).
6. Inlets and Outlet: Threaded or compression fittings, integral check valves on inlets.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

7. Finish: Rough or chrome-plated bronze.
 8. Pressure-Temperature:
 - a. Minimum Flow: 0.25 GPM
 - b. Maximum Pressure: 125 PSIG.
 - c. Maximum Hot Water temperature: 200°F.
 - d. Approach Temperature 5°F above set point.
 - e. Temperature Adjustment Range: 90°F -140°F
 - f. Tempered-Water Setting: 105 deg F.
 9. Accessories:
 - a. Cold water by-pass port (single fixture only). Not required for single handle or sensor faucet installations.
 - b. Mounting bracket.
 - c. Ball valves.
 - d. For concealed wall mounted valves, provide recessed cabinet, white enamel, 18-gauge body and door, with left-hand hinge, plexiglas window in door and inlet/outlet knock-out holes for mounting flexibility.
- C. Emergency, Safety-Fixture, Thermostatic, Water Tempering Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Navigator Series or comparable product by one of the following:
 - a. Apollo Valves; Conbraco Industries, Inc.
 - b. Bradley Corporation
 - c. Lawler Manufacturing Company, Inc
 - d. Leonard Valve Company
 - e. POWERS; A WATTS Brand
 - f. WATTS
 - g. Zurn Industries, LLC
 2. Type: Thermostatically controlled, emergency fixture thermostatic water mixing valve.
 3. Standard: ANSI Z358.1, thermostatically controlled, water tempering valve.
 4. Pressure Rating: 125 psig minimum unless otherwise indicated.
 5. Material: Lead-free, bronze body with corrosion-resistant interior components.
 6. Temperature Control: Adjustable.
 7. Accessories: Manual temperature control, strainer check stops on hot- and cold-water supplies, inlet/outlet shutoff, built-in cold water bypass.
 8. Inlets and Outlet: Threaded.
 9. Finish: Rough or chrome-plated bronze.
 10. Tempered-Water Setting: 85 deg F.
 11. Tempered-Water Design Flow Rate:
 - a. Emergency Eyewash Units: Minimum flushing fluid of 0.4 gpm @ 30 psi.
 - b. Emergency Eye/Facewash Units & Drench Hoses: Minimum flushing fluid of 3 gpm @ 30 psi.
 - c. Emergency Showers: Minimum flushing fluid of 20 gpm @ 30 psi.
 - d. Based on manufacturer's requirements, emergency shower and combination units shall be provided with a flow restrictor as required to utilize a thermostatic mixing valve.
 12. For concealed wall mounted valves, provide recessed cabinet, white enamel, 18-gauge body and door, with left-hand hinge, plexiglas window in door and inlet/outlet knock-out holes for mounting flexibility.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.6 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
 - 2. Body: Bronze for NPS 2 and smaller.
 - 3. End Connections: Threaded for NPS 2 and smaller.
 - 4. Screen: Stainless steel with round perforations unless otherwise indicated.
 - 5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
 - c. Strainers NPS 5 and Larger: 0.125 inch.
 - 6. Drain: Factory-installed, hose-end drain valve.

2.7 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - 2. Pressure Rating: 400-psig minimum CWP.
 - 3. Size: NPS 3/4.
 - 4. Body: Copper alloy.
 - 5. Ball: Chrome-plated brass.
 - 6. Seats and Seals: Replaceable.
 - 7. Handle: Vinyl-covered steel.
 - 8. Inlet: Threaded or solder joint.
 - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 SHOCK ABSORBERS/WATER-HAMMER ARRESTERS

- A. Shock Absorbers/Water-Hammer Arresters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Jay R. Smith Mfg. Co
 - c. Josam Company
 - d. MIFAB, Inc
 - e. Oatey
 - f. Precision Plumbing Products
 - g. Sioux Chief Manufacturing Company, Inc.
 - h. WATTS
 - i. Zurn Industries, LLC
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Copper tube with piston.
 - 4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes B through F.
 - a. Shock absorbers shall be the same size as the line on which they are installed, up to 1" pipe size. Pipe lines larger than 1" shall have 1-inch shock absorbers installed.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.9 TRAP-SEAL PRIMER DEVICE

- A. Flush Valve, Trap-Seal Primer Device:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision Plumbing Products Model FVP or comparable product by one of the following:
 - a. Jay R. Smith Mfg. Co
 - b. MIFAB, Inc
 - c. Precision Plumbing Products
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. WATTS
 - f. Zurn Industries, LLC
 - 2. Type: Vacuum breaker trap primer
 - 3. Body: 1-1/2" x 12" 17 GA with compression fitting.
 - 4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 - 6. Finish: Chrome plated.
 - 7. Accessories: Vacuum breaker, chrome plated wall flange, compression fittings.
- B. Pressure Drop, Trap-Seal Primer Device:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision Plumbing Products Model PR or comparable product by one of the following:
 - a. Jay R. Smith Mfg. Co
 - b. MIFAB, Inc
 - c. Precision Plumbing Products
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. WATTS
 - f. Zurn Industries, LLC
 - 2. Type: Automatic pressure drop activated trap primer valve.
 - 3. Standard: ASSE 1018.
 - 4. Pressure Rating: 125 psig minimum.
 - 5. Body: Brass.
 - 6. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 7. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 - 8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.10 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flex-Hose Co., Inc
 - 2. Flexicraft Industries
 - 3. Hyspan Precision Products, Inc
 - 4. Metraflex Company (The)
 - 5. Proco Products, Inc
 - 6. Unaflex

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 250 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install unions or flanges at all connections to each piece of equipment and on both sides of valves and other in-line devices that require removal for maintenance.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve and pump.
- E. Install water-hammer arresters in water piping at the end of all branch lines and as indicated on the drawings according to PDI-WH 201. Pipe extensions shall not be used in place of shock absorbers.
- F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- G. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- H. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow. Coordinate 120-v power source with Division 26.
- I. Install meters with inlet and outlet shutoff valves. Install bypass around meter with shutoff valve.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each reduced-pressure-principle backflow preventer and double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 221123 - DOMESTIC WATER RECIRCULATION PUMPS

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. In-line, recirculation pumps.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Comply with pump manufacturer's written instructions for handling.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of pumps that fail in materials or workmanship within specified warranty period.
 - 1. One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. UL Compliance: UL 778 for motor-operated water pumps.
- C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.
- D. Seismic Performance: Inline, domestic-water pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 HORIZONTALLY MOUNTED, IN-LINE, CIRCULATION PUMPS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Bell & Gossett Series NBF circulator or comparable product by one of the following:
 - 1. Armstrong Pumps Inc.
 - 2. Bell & Gossett Domestic Pump; ITT Corporation.
 - 3. Grundfos Pumps Corp.
 - 4. TACO Incorporated.
- B. Description: Factory-assembled and -tested, in-line, horizontal, permanently lubricated, wet rotor circulation type.
- C. Capacities and Characteristics: Refer to drawings.
- D. Materials of Construction
 - 1. Body: Lead-free brinze.
 - 2. Shaft: Ceramic
 - 3. Bearings: Carbon, lubricated by the circulating fluid
- E. Operating Data
 - 1. Maximum Working Pressure: 150 psi
 - 2. Maximum Working Temperature: 200°F

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Minimum Working Temperature: 40°F

- F. Motor: Non-overloading at any point on the pump curve with built-in thermal/impedance protection

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 CONTROLS

- A. Recirculation pumps shall function on an occupied/unoccupied and temperature control.

1. Occupied/Unoccupied Control:

- a. Turns circulator OFF when building is unoccupied.
- b. Turns circulator ON 1-hour (adj) before building is occupied.

2. Temperature Control:

- a. Adjustable set point from 80 to 140°F.
- b. Turns circulator OFF when water temperature reaches set point.
- c. Turns circulator ON when water temperature is 10 degrees F below set point.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Mount pumps in orientation complying with manufacturer's written instructions.
- C. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.
- 1. Comply with requirements for vibration isolation devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
 - 2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Install pressure switches in water-supply piping.
- E. Install thermostats in hot-water return piping.

3.3 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to pumps, allow space for service and maintenance.
- C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the pumps.
 - a. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."
- D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.
 - 1. Install pressure gauge at suction of each pump and pressure gauge at discharge of each pump. Install at integral pressure-gauge tapings where provided or install pressure-gauge connectors in suction and discharge piping around pumps.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring between temperature controllers and devices.

3.5 IDENTIFICATION

- A. Identify system components.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Set pressure switches, thermostats, timers, and time-delay relays for automatic starting and stopping operation of pumps.
 - 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 7. Start motor.
 - 8. Open discharge valve slowly.
 - 9. Adjust temperature settings on thermostats.
 - 10. Adjust timer settings.

3.8 ADJUSTING

- A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 221316 - SANITARY WASTE AND VENT PIPING AND SPECIALTIES

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. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 2. Hubless, cast-iron soil pipe and fittings.
 - 3. Specialty pipe fittings.
 - 4. Encasement for underground metal piping.
 - 5. Floor drains.
 - 6. Trap-seal insert device.
 - 7. Cleanouts.
 - 8. Miscellaneous sanitary drainage piping specialties.
- B. Contractor shall perform all work within the building and to a point five (5) feet from the building wall, unless otherwise noted.
 - 1. Contractor shall coordinate with site sanitary drainage services provided under another Division.
 - 2. The contractor shall make the final connection of the building sanitary drainage to the site sanitary drainage.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.5 QUALITY ASSURANCE

- A. Piping, drains and specialty materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than ten days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
 - 2. Waste, Force-Main Piping: 50 psig.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. All pipe and fittings shall be from a United States domestic manufacturer.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AB & I Foundry
 - 2. Charlotte Pipe and Foundry Company
 - 3. Tyler Pipe
- B. Pipe and Fittings:
 - 1. Marked with CISPI collective trademark and NSF certification mark.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Class: ASTM A 74, Service class.

C. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AB & I Foundry
2. Charlotte Pipe and Foundry Company
3. Tyler Pipe

B. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standard: ASTM A 888 or CISPI 301.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky
 - b. Charlotte Pipe and Foundry Company
 - c. Ideal-Tridon
 - d. Tyler Pipe
2. Standard: ASTM C 1540.
3. Description: Corrugated stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Fernco Inc
 - 2) Mission Rubber Company, LLC; a division of MCP Industries
 - 3) Plastic Oddities
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. End Connections: Same size as and compatible with pipes to be joined.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Dielectric Fittings
 - 1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 - 2. Dielectric unions shall not be used. In lieu of dielectric union, use an approved brass fitting.
 - 3. Dielectric Flanges:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) WATTS
 - 2) Wilkins
 - 3) Zurn Industries, LLC
 - b. Standard: ASSE 1079.
 - c. Factory-fabricated, bolted, companion-flange assembly.
 - d. Pressure Rating: 150 psig minimum at 180 deg F.
 - e. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch minimum thickness.
- C. Form: Tube.
- D. Color: Black or natural.

2.7 FLOOR DRAINS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co
 - b. Josam Company
 - c. MIFAB, Inc
 - d. Sioux Chief Manufacturing...
 - e. Wade; a subsidiary of McWane Inc.
 - f. WATTS
 - g. Zurn Industries, LLC.
- B. FD-1 (Finished Floor):
 - 1. Basis-of-Design Product: Provide Josam 30000-S-ARE-50 or comparable product
 - 2. Pattern: Floor drain.
 - 3. Body Material: Cast iron.
 - 4. Drainage Flange: Required, double.
 - 5. Flashing Collar: Required, non-puncturing.
 - 6. Weepholes: Required.
 - 7. Outlet: Bottom.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

8. Backwater Valve: Not required.
 9. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant epoxy.
 10. Sediment Bucket: Not required.
 11. Strainer: Adjustable
 12. Strainer Material and Finish: Satin nickel-bronze, copper alloy.
 13. Top Shape: Square.
 14. Dimensions of Top or Strainer: 6"x6".
 15. Funnel: Not required.
 16. Features: 1/2" trap-seal primer valve drain connection.
- C. FD-2 (Shower):
1. Basis-of-Design Product: Provide Josam 30000-A-50 or comparable product
 2. Pattern: Floor drain.
 3. Body Material: Cast iron.
 4. Drainage Flange: Required, double.
 5. Flashing Collar: Required, non-puncturing.
 6. Weepholes: Required.
 7. Outlet: Bottom.
 8. Strainer: Adjustable
 9. Strainer Material and Finish: Satin nickel-bronze, copper alloy.
 10. Top Shape: Round.
 11. Dimensions of Top or Strainer: 5" diameter.
 12. Features: 1/2" trap-seal primer valve drain connection.
- D. FD-3 (Mechanical Rooms):
1. Basis-of-Design Product: Provide Josam 32100-AE-ARE-50 or comparable product
 2. Pattern: Floor drain.
 3. Body Material: Cast iron.
 4. Drainage Flange: Required, double.
 5. Flashing Collar: Required, non-puncturing.
 6. Weepholes: Required.
 7. Outlet: Bottom.
 8. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant epoxy.
 9. Strainer: Adjustable
 10. Strainer Material and Finish: Satin nickel-bronze, copper alloy.
 11. Grate: Anti-tilting with perimeter drainage slots.
 12. Top Shape: Round.
 13. Dimensions of Top or Strainer: 9" diameter.
 14. Top Loading Classification: Medium duty.
 15. Features: 1/2" trap-seal primer valve drain connection.
- E. FD-4 (Condensate):
1. Basis-of-Design Product: Provide Josam 30000-E1-ARE-50 or comparable product
 2. Pattern: Floor drain.
 3. Body Material: Cast iron.
 4. Drainage Flange: Required, double.
 5. Flashing Collar: Required, non-puncturing.
 6. Weepholes: Required.
 7. Outlet: Bottom.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

8. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant epoxy.
9. Strainer: Adjustable with extended rim.
10. Strainer Material and Finish: Satin nickel-bronze, copper alloy.
11. Top Shape: Round.
12. Dimensions of Top or Strainer: 6" diameter.
13. Features: 1/2" trap-seal primer valve drain connection.

2.8 FLOOR SINKS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co
 - b. Josam Company
 - c. MIFAB, Inc
 - d. Sioux Chief Manufacturing...
 - e. Wade; a subsidiary of McWane Inc.
 - f. WATTS
 - g. Zurn Industries, LLC.
- B. FS-2 (Food Service - Stainless Steel):
 1. Basis-of-Design Product: Provide Zurn Z1751-P-2 or comparable product
 2. Pattern: Floor sink, 8" deep.
 3. Body Material: Type 304 stainless steel.
 4. Outlet: Bottom.
 5. Coating on Interior and Exposed Exterior Surfaces: None.
 6. Sediment Bucket: Not required.
 7. Internal Dome Strainer: Required, stainless steel.
 8. Strainer Material and Finish: Stainless steel.
 9. Top Shape: Square.
 10. Grate: 1/2 grate.
 11. Dimensions of Top or Strainer: 12"x12".
 12. Funnel: Not required.
 13. Features: 1/2" trap-seal primer valve drain connection.

2.9 CLEANOUTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Jay R. Smith Mfg. Co.
 2. Josam Company; Josam Div.
 3. MIFAB, Inc.
 4. Tyler Pipe.
 5. Wade.
 6. WATTS.
 7. Zurn Industries, LLC.
- B. Exposed and Above-Ceiling Cleanouts:
 1. Basis-of-Design Product: Provide Josam Series 58900 or comparable product.
 2. Size: Same as connected branch.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Body Material: No-hub, cast-iron soil pipe test tee] as required to match connected piping.
 4. Closure: Bronze, countersunk plug.
 5. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.
- C. Finished Floor Cleanouts:
1. Basis-of-Design Product: Provide Josam Series 55000-1-SQ or comparable product.
 2. Size: Same as connected branch.
 3. Type: Adjustable cast-iron housing.
 4. Body or Ferrule: Cast iron.
 5. Outlet Connection: No hub, hub with gasket or inside caulk (based on location).
 6. Closure: Internal cast-iron or plastic plug.
 7. Adjustable Housing Material: Cast iron with threads.
 8. Cover Material and Finish: Scoriated satin nickel-bronze, copper alloy.
 9. Frame and Cover Shape: Square.
 10. Top Loading Classification: Light Duty.
 11. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- D. Unfinished Floor Cleanouts:
1. Basis-of-Design Product: Provide Josam Series 58460A-AE or comparable product.
 2. Size: Same as connected branch.
 3. Type: Adjustable cast-iron housing.
 4. Body: Cast iron.
 5. Outlet Connection: No hub, hub with gasket or inside caulk (based on location).
 6. Closure: Internal bronze countersunk plug.
 7. Cover Material and Finish: Satin nickel-bronze, copper alloy.
 8. Cover Shape: Round.
 9. Top Loading Classification: Light Duty.
 10. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- E. Wall Cleanouts:
1. Basis-of-Design Product: Provide Josam Series 58910-Z or comparable product.
 2. Size: Same as connected drainage piping.
 3. Body: No-hub, cast-iron soil pipe as required to match connected piping.
 4. Closure Plug:
 - a. Bronze.
 - b. Countersunk head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as, or not more than, one size smaller than cleanout size.
 5. Wall Access For Concealed Riser:
 - a. Round, flat, nickel-bronze, copper-alloy cover plate with screw.
 6. Wall Access for Concealed Riser:
 - a. Square, stainless-steel wall-installation frame and cover.
- F. Exterior Underground Cleanouts:
1. Basis-of-Design Product: Provide Josam Series 58360 or comparable product.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Size: Same as connected branch.
3. Type: Adjustable cast-iron housing.
4. Body or Ferrule: Cast iron.
5. Outlet Connection: Hub with gasket.
6. Closure: Internal bronze countersunk plug.
7. Adjustable Housing Material: Cast iron with threads.
8. Cover Material and Finish: Scoriated satin finish bronze.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Light Duty.
11. Riser: ASTM A 74, Extra-heavy class, cast-iron drainage pipe fitting and extension to grade.
12. Concrete: Set in twelve (12) inches by twelve (12) inches by eight (8) inches concrete finished flush with grade.

G. Test Tees:

1. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301.
2. Size: Same as connected drainage piping.
3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or no-hub, cast-iron soil-pipe test tee as required to match connected piping.
4. Closure Plug: Countersunk, brass.
5. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

2.10 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."
- B. Pipe and fittings shall be moved to the trench, carefully lowered and set to line and grade. Pipe shall be laid on the shaped sub-grade. No blocking will be permitted and the bedding shall be such that it forms a continuous bearing with a minimum width of bearing equal to 0.6 the outside diameter of the pipe for the full length of the pipe, except for that portion at the bell hole.
- C. No pipe or fitting shall be installed until sufficient trench has been completely excavated to satisfy the Architect that no unforeseen obstructions of any kind are likely to be encountered. Pipe shall be cut by the Contractor when required without any additional compensation. Special care shall be exercised by the Contractor to prevent damage to any pipe.
- D. Before placing in the trench, each pipe or fitting shall be carefully cleaned of any foreign substance which may have collected therein and shall be kept clean at all times thereafter. For this purpose, the open ends of all pipes and fittings in the trench shall be closed to the satisfaction of the Architect before leaving the work for the night and for all holidays or other items of interruption to the work.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. 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.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- H. Install piping to allow application of insulation.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 - 3. Horizontal Kitchen Grease Waste Piping: 2 percent downward in direction of flow.
 - 4. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping in corrosive soils according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.
- O. Where soil conditions require the use of pier or piling supported grade beam construction or in filled ground where the soil compaction is less than 95%, underground PVC piping shall be suspended from the structural slab with stainless steel hangers and rods. Installation shall be in accordance with ASTM F2536 (Standard Guide for Installing Plastic DWV Piping Suspended from On-Grade Slabs).
- P. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
- 2. Install drains in sanitary waste gravity-flow piping.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of interior walls, ceilings, and floors.
 - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of exterior concrete walls and slabs.
 - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for exposed piping penetrations of finished walls, ceilings, and floors.
 - 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless, Cast-Iron Soil Piping Coupled Joints:
 - 1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
- D. Joint Restraints and Sway Bracing:
 - 1. Provide joint restraints and sway bracing for sanitary drainage piping joints to comply with the following conditions:
 - a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
 - b. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
 - c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.4 SPECIALTY INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in ODs.
 - 2. In Drainage Piping: Nonpressure transition couplings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- C. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains slightly below elevation of surrounding finished floor to allow positive floor drainage.
 - 3. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual deep-seal traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- D. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- G. Install deep-seal traps on floor drains and other indirect waste outlets, unless otherwise noted.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- J. Install blocking reinforcement for wall-mounting-type specialties.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for metal piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for plastic piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- F. Support vertical runs of metal piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of plastic piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 48 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure:
 - a. Test waste and vent piping except outside leaders on completion of roughing-in.
 - b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - c. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - d. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.
- C. Reinspection: Piping will be considered defective if it does not pass tests and inspections. Make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- E. All new and existing sanitary drainage systems to the point of service connection or termination outside the building footprint for sanitary drainage shall be completely cleared with a plumber's snake and flushed after a building is completed and prior to Substantial Completion.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.
- E. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
 - 1. If drains are not covered and it is suspected that dirt, debris or trash has entered the drainage system, the interior drainage system shall be professionally cleaned to the Architect's satisfaction and at no expense to the Owner.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil, waste and vent piping shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Underground, soil, waste, and vent piping shall be the following:
 - 1. Hub and spigot, cast-iron soil pipe and fittings, service class; gaskets; and gasketed joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221316

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 221413 - STORM DRAINAGE PIPING AND SPECIALTIES

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. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 2. Hubless, cast-iron soil pipe and fittings.
 - 3. Galvanized-steel pipe and fittings.
 - 4. Copper tube and fittings.
 - 5. PVC pipe and fittings.
 - 6. Specialty pipe and fittings.
 - 7. Encasement for underground metal piping.
 - 8. Roof drains.
 - 9. Miscellaneous storm drainage piping specialties.
- B. Related Requirements:
 - 1. Section 221316 "Sanitary Waste and Vent Piping and Specialties" for cleanout product data.
- C. Roof and overflow drains shall be furnished by plumbing contractor, installed by the plumbing contractor and adjusted by the roofing contractor. Roofing contractor(s) shall be responsible for flashing all roof penetrations thru roof systems to maintain warranties.
- D. Contractor shall perform all work within the building and to a point five (5) feet from the building wall, unless otherwise noted.
 - 1. Contractor shall coordinate with site storm drainage services provided under another Division.
 - 2. The contractor shall make the final connection of the building storm drainage to the site storm drainage.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

- A. Piping and specialty materials shall bear label, stamp, or other markings of specified testing agency.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than ten days in advance of proposed interruption of storm drainage service.
 - 2. Do not proceed with interruption of storm drainage service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.
 - 2. Storm Drainage, Force-Main Piping: 50 psig.
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. All pipe and fittings shall be from a United States domestic manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AB & I Foundry
 - 2. Charlotte Pipe and Foundry Company
 - 3. Tyler Pipe
- B. Pipe and Fittings:
 - 1. Marked with CISPI collective trademark and NSF certification mark.
 - 2. Class: ASTM A 74, Service class.
- C. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AB & I Foundry
 - 2. Charlotte Pipe and Foundry Company
 - 3. Tyler Pipe
- B. Pipe and Fittings:
 - 1. Marked with CISPI collective trademark and NSF certification mark.
 - 2. Standard: ASTM A 888 or CISPI 301.
- C. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky
 - b. Charlotte Pipe and Foundry Company
 - c. Ideal-Tridon
 - d. Tyler Pipe
 - 2. Standard: ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Tubular USA
 - 2. U.S. Steel
 - 3. Wheatland Tube Company
- B. Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.
- C. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Galvanized-Steel Pipe Pressure Fittings:
 - 1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
 - 2. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

2.6 COPPER TUBE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cambridge-Lee Industries, LLC
 - 2. Cerro Flow Products, LLC
 - 3. Mueller Industries, Inc.
 - 4. Wieland Copper Products, LLC
- B. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- C. Copper Pressure Fittings:
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy fittings or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.7 PVC PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Charlotte Pipe and Foundry Company
 - 2. Mueller Industries, Inc.
 - 3. National Pipe and Plastic, Inc.
 - 4. North America Pipe Corporation
- B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. Solid-Wall PVC Pipe: ASTM D 2665; drain, waste, and vent.
- D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- E. Adhesive Primer: ASTM F 656.
- F. Solvent Cement: ASTM D 2564.

2.8 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Fernco Inc
 - 2) Mission Rubber Company, LLC; a division of MCP Industries
 - 3) Plastic Oddities
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. End Connections: Same size as and compatible with pipes to be joined.
4. Pressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co
 - 2) EBAA Iron, Inc.
 - 3) JCM Industries, Inc
 - 4) Romac Industries, Inc.
 - b. Standard: AWWA C219.
 - c. Description: Metal, sleeve-type couplings same size as pipes to be joined, and with pressure rating at least equal to and ends compatible with pipes to be joined.
 - d. Center-Sleeve Material: Manufacturer's standard.
 - e. Gasket Material: Natural or synthetic rubber.
 - f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric unions shall not be used. In lieu of dielectric union, use an approved brass fitting.
3. Dielectric Flanges:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) WATTS
 - 2) Wilkins
 - 3) Zurn Industries, LLC
 - b. Standard: ASSE 1079.
 - c. Factory-fabricated, bolted, companion-flange assembly.
 - d. Pressure Rating: 150 psig minimum at 180 deg F.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- e. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch minimum thickness.
- C. Form: Tube.
- D. Color: Black or natural.

2.10 ROOF DRAINS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Jay R. Smith Mfg. Co.
 - 2. Josam Company; Josam Div.
 - 3. MIFAB, Inc.
 - 4. WATTS.
 - 5. Zurn Industries, LLC.
- B. RD-1: Large-Sump, General-Purpose Roof Drains:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam 21500-AE or comparable product.
 - 2. Standard: ASME A112.6.4.
 - 3. Body Material: Cast iron.
 - 4. Dimension of Body: Nominal 14-to 16-inch diameter.
 - 5. Deck Clamp Assembly and Drain Receiver: Required
 - 6. Combination Clamp Ring and Gravel Stop: Required.
 - 7. Outlet: Bottom.
 - 8. Outlet Type: No hub.
 - 9. Extension Collars: Adjustable
 - 10. Underdeck Clamp: Required.
 - 11. Dome Material: Cast iron.
 - 12. Wire Mesh: Not required.
 - 13. Internal Water Dam: Not required.
- C. OD-1: Large-Sump, Overflow Roof Drains:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam 21500-AE or comparable product.
 - 2. Standard: ASME A112.6.4.
 - 3. Body Material: Cast iron.
 - 4. Dimension of Body: Nominal 14-to 16-inch diameter.
 - 5. Deck Clamp Assembly and Drain Receiver: Required
 - 6. Combination Clamp Ring and Gravel Stop: Required.
 - 7. Outlet: Bottom.
 - 8. Outlet Type: No hub.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

9. Extension Collars: Adjustable
10. Underdeck Clamp: Required.
11. Dome Material: Cast iron.
12. Wire Mesh: Not required.
13. Internal Water Dam: 3 inches high.
14. Internal Water Dam Material: Cast iron.

D. RD-1/OD-1: Large-Sump, Combination General-Purpose and Overflow Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam 22500-AE or comparable product.
2. Standard: ASME A112.6.4.
3. Body Material: Cast iron.
4. Dimension of Body: Nominal 14-to 16-inch diameter, each.
5. Deck Clamp Assembly and Drain Receiver: Required
6. Combination Clamp Ring and Gravel Stop: Required.
7. Outlet: Bottom, each.
8. Outlet Type: No hub, each.
9. Extension Collars: Adjustable, each
10. Underdeck Clamp: Required.
11. Dome Material: Cast iron, each.
12. Wire Mesh: Not required.
13. Internal Water Dam: 3 inches high.
14. Internal Water Dam Material: Cast iron.

2.11 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Jay R. Smith Mfg. Co.
2. Josam Company; Josam Div.
3. MIFAB, Inc.
4. WATTS.
5. Zurn Industries, LLC.

B. Downspout Boots:

1. Basis-of-Design Product: Provide Zurn Z191-RD-CA or comparable product.
2. Description: Manufactured, ASTM A 48/A 48M, coated cast-iron body, with strap or ears for attaching to building; NPS 4 outlet; cleanout access plug.
3. Size: Inlet size to match downspout and NPS 4 outlet.

C. Downspout Nozzles:

1. Basis-of-Design Product: Provide Zurn Z199 or comparable product.
2. Description: Cast nickel bronze body with threaded inlet and bronze wall flange with mounting holes.
3. Size: Same as connected conductor.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.12 CLEANOUTS

- A. Refer to Section 221316 "Sanitary Waste and Vent Piping and Specialties" for cleanout product data.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."
- B. Pipe and fittings shall be moved to the trench, carefully lowered and set to line and grade. Pipe shall be laid on the shaped sub-grade. No blocking will be permitted and the bedding shall be such that it forms a continuous bearing with a minimum width of bearing equal to 0.6 the outside diameter of the pipe for the full length of the pipe, except for that portion at the bell hole.
- C. No pipe or fitting shall be installed until sufficient trench has been completely excavated to satisfy the Architect that no unforeseen obstructions of any kind are likely to be encountered. Pipe shall be cut by the Contractor when required without any additional compensation. Special care shall be exercised by the Contractor to prevent damage to any pipe.
- D. Before placing in the trench, each pipe or fitting shall be carefully cleaned of any foreign substance which may have collected therein and shall be kept clean at all times thereafter. For this purpose, the open ends of all pipes and fittings in the trench shall be closed to the satisfaction of the Architect before leaving the work for the night and for all holidays or other items of interruption to the work.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. 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.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.
 - 1. Do not change direction of flow more than 90 degrees.
 - 2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm Drainage Piping: 2 percent downward in direction of flow.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping in corrosive soils according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install aboveground PVC piping according to ASTM D 2665 (Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings).
- O. Install underground PVC piping according to ASTM D 2321 (Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications).
- P. Where soil conditions require the use of pier or piling supported grade beam construction or in filled ground where the soil compaction is less than 95%, underground PVC piping shall be suspended from the structural slab with stainless steel hangers and rods. Installation shall be in accordance with ASTM F2536 (Standard Guide for Installing Plastic DWV Piping Suspended from On-Grade Slabs).
- Q. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Install encasement on piping in corrosive soils according to ASTM A 674 or AWWA C105/A 21.5.
- R. Install force mains at elevations indicated.
- S. Plumbing Specialties:
 1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- U. Install sleeves for piping penetrations of interior walls, ceilings, and floors.
 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of exterior concrete walls and slabs.
 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for exposed piping penetrations of finished walls, ceilings, and floors.
 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 SPECIALTY INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Install expansion joints, if indicated, in roof drain outlets.
 3. Position roof drains for easy access and maintenance.
- B. Install downspout boots at grade with top 12 inches above grade. Secure to building wall.
- C. Install downspout nozzles at exposed bottom of conductors where they spill onto grade.
- D. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate cleanouts at base of each vertical storm piping conductor.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- G. Install test tees in vertical conductors and near floor.
- H. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- I. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.

3.4 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless, Cast-Iron Soil Piping Coupled Joints:
 - 1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
 - 1. Cut threads full and clean using sharp dies.
 - 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - c. Do not use pipe sections that have cracked or open welds.
- D. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- E. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendices.
- F. Joint Restraints and Sway Bracing:
 - 1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
 - a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
- c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.5 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in ODs.
 - 2. In Drainage Piping: Nonpressure transition couplings.
 - 3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
 - 4. In Underground Force-Main Piping:
 - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
 - b. NPS 2 and Larger: Pressure transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for metal piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for plastic piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- F. Support vertical runs of metal piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of plastic piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
 - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
- D. Connect force-main piping to the following:
 - 1. Sump Pumps: To sump pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance.

3.8 IDENTIFICATION

- A. Identify exposed storm drainage piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.

3.10 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 48 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 3. Test Procedure:
 - a. Test storm drainage piping, except outside leaders, on completion of roughing-in.
 - b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - c. From 15 minutes before inspection starts until completion of inspection, water level must not drop.
 - d. Inspect joints for leaks.
 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.
 - D. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
 - a. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.
 - E. Reinspection: Piping will be considered defective if it does not pass tests and inspections. Make required corrections and arrange for reinspection.
 - F. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - G. All new and existing storm drain systems to the point of service connection or termination outside the building footprint for storm drainage shall be completely cleared with a plumber's snake and flushed after a building is completed and prior to Substantial Completion..
- 3.11 CLEANING AND PROTECTION
- A. Clean interior of piping. Remove dirt and debris as work progresses.
 - B. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
 - C. Place plugs in ends of uncompleted piping at end of each day or when work stops.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.12 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 - 2. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Underground storm drainage piping shall be the following:
 - 1. Hub and spigot, cast-iron soil pipe and fittings, service class; gaskets; and gasketed joints.
 - 2. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground storm drainage force mains shall be the following:
 - 1. Galvanized-steel pipe, pressure fittings, and threaded joints.
 - 2. Fitting-type transition couplings if dissimilar pipe materials.
- E. Underground storm drainage force mains shall be the following:
 - 1. Soft copper tube; Type L copper pressure fittings; and soldered joints.
 - 2. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.
 - 3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

END OF SECTION 221413

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Natural gas-fired, tank-type, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, venting requirements, gas-supply requirements, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.
- B. Seismic Qualification Data: Certificates, for fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: For natural gas-fired, tank-type, storage, domestic-water heaters.
- D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranty: For special warranty.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Natural Gas-Fired, Tank-Type, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One year.
 - b. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7]<Insert requirement>.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- C. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with applicable thermal efficiency and standby loss requirements of ASHRAE/IES 90.1 and the U.S. Department of Energy.
 - 1. Comply with efficiency requirements in ASHRAE 189.1, which supersede re-

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

quirements in ASHRAE/IESNA 90.1.

D. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 NATURAL GAS-FIRED, TANK-TYPE, STORAGE, DOMESTIC-WATER HEATERS

A. Natural Gas-Fired, Tank-Type, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation
 - b. Bradford White Corporation
 - c. Lochinvar, LLC
 - d. PVI; A WATTS Brand
 - e. Raypak; a Rheem brand
 - f. Rheem Manufacturing Company
 - g. Ruud Water Heaters; a Rheem brand
 - h. [State Water Heaters]
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: ANSI Z21.10.3/CSA 4.3.
4. Storage-Tank Construction: Steel storage tank with 160-psig maximum working-pressure rating; provide ASME construction where indicated.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tap-pings to tank before testing.
 - 1) Domestic-Water Connections: NPS 1-1/2 top inlet and outlet connections.
 - 2) Drain Connection: Factory-installed drain valve.
 - b. Lining: Glass-lined tank with manufacturer's proprietary ceramic coating fused to steel for protection of surfaces exposed to potable water.
5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rods: Factory-installed, long-life anode rods with stainless steel cores.
 - b. Cold-Water Inlet: Provide scale-reducing inlet arrangement integral to the heater where offered by manufacturer.
 - c. Handhole Cleanout: Boiler-type handhole cleanout for tank access and cleaning.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Insulation: Foam insulation surrounding storage tank to reduce standby heat loss and comply with applicable energy-code requirements.
- e. Jacket: Heavy-gauge steel jacket with baked enamel finish over bonderized undercoat.
- f. Burner: Fan-assisted, ultra-low-NOx premix burner assembly for natural gas fuel, complying with applicable low-NOx emission requirements.
- g. Ignition: Intermittent electronic ignition system with spark igniter and flame-failure response.
- h. Temperature Control: Fully automatic digital control system with adjustable thermostat range from 120 to 180 deg F.
- i. Safety Controls: Integral automatic gas shutoff system, manual reset gas shutoff device, and high-temperature protection.
- j. Combination Temperature-and-Pressure Relief Valve: Factory-installed CSA-certified and ASME-rated temperature-and-pressure relief valve.
- 6. Special Requirements: UL design certified for commercial water heater service, certified for use on combustible flooring, and capable of 180 deg F hot-water service.
- 7. Venting: Category I, fan-assisted combustion appliance suitable for standard double-wall Type B metal venting and common venting where permitted by NFPA 54 and manufacturer instructions.
- 8. Air-Flapper Assembly: Stainless steel air flapper within premix system to reduce standby heat loss in lieu of externally mounted flue damper.
- 9. Gas Supply Pressure: Natural gas supply pressure shall be 3.5 inches w.c. minimum for models through 275 MBH input and 4.5 inches w.c. minimum for models 310 MBH input and larger; maximum supply pressure shall be 14 inches w.c.
- B. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
 - 1. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a. NPS 2 (DN 50) and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - b. NPS 2-1/2 (DN 65) and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

2.3 WATER HEATER ACCESSORIES

- A. Domestic-Water Expansion Tanks:
 - 1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and balancing valves to provide balanced flow through each domestic-water heater.
- F. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
- H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- I. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include [1/2-psig][2-psig][5-psig] pressure rating as required to match gas supply.
- J. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
- K. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
- L. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- M. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of [18 inches]<Insert dimension> above the floor.
- N. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC-WATER HEATER

- A. Commercial, Natural Gas-Fired, Tank-Type Water Heater Mounting: Install indoor commercial water heaters level and plumb on concrete pads. Comply with requirements for concrete pads specified in Section 033000 "Cast-in-Place Concrete," Drawings, and manufacturer's written installation instructions.
- B. Install natural gas-fired, tank-type, storage domestic-water heaters indoors, level and plumb, in accordance with Drawings, manufacturer's written instructions, NFPA 54, and referenced standards.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" and Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
- D. Where T&P relief valve is not factory installed, install combination temperature-and-pressure relief valve in top portion of storage tank with sensing element extending into tank. Extend relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Pipe factory-installed tank drain valve and relief-valve discharge to approved indirect waste locations as indicated.
- F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."
- G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

- H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks where integral or fitting-type heat traps are not provided and where required by ASHRAE/IES 90.1.
- I. Fill domestic-water heaters with water.
- J. Charge domestic-water expansion tanks with air to required system pressure.
- K. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for natural gas piping specified in Section 231123 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to water heaters, allow space for service, maintenance, handhole cleanout access, anode replacement, burner and blower service, vent connection access, and removal of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency:
 - 1. Owner will engage a qualified testing agency to perform tests and inspections.
 - 2. Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. 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 water heater is filled, gas piping has been tested and purged, venting is complete, and electrical circuitry has been energized, start units to confirm proper ignition, burner operation, fan-assisted combustion, safety shutdown, and temperature-control operation.
 - 3. Test and adjust controls and safeties, including thermostat, manual reset gas shutoff device, automatic gas shutoff, flame-failure response, and temperature-and-pressure relief discharge arrangement. Replace damaged and malfunctioning controls and equipment.
- E. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain indoor, natural gas-fired, tank-type, storage domestic-water heaters. Training shall include startup, shutdown, temperature adjustment, burner and ignition operation, fan-assisted combustion, safety controls, venting requirements, drain valve use, handhole cleanout access, anode replacement, and routine maintenance. Training shall be a minimum of one hour.

END OF SECTION 223400

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 224200 - PLUMBING FIXTURES

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. Plumbing fixtures.
 - 2. Supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all plumbing fixtures indicated on the contract drawings and as specified herein.
- B. The Contractor shall provide metal supports necessary to adequately and substantially hang and set all fixtures subject to the approval of the Architect. No wood grounds, wood plugs, or expansion bolts shall be permitted for fixture support. Provide floor mounted carriers where specified below and as required to hang fixtures.
- C. NSF Standard: Comply with NSF standards for materials that will be in contact with potable water.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Unless specified to be provided integral to the faucet, all handwashing fixtures (lavatories, hand sinks) shall be provided with factory calibrated mixing valve which conforms to ASSE 1070 not to exceed 110°.

2.2 MANUFACTURERS

- A. Water Closet Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Standard America
 - 2. Kohler Co
 - 3. Sloan Valve Company
 - 4. TOTO USA, INC
 - 5. Zurn Industries, LLC
- B. Toilet Seat Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Standard America.
 - 2. Bemis Manufacturing Company.
 - 3. Church Seats.
 - 4. Kohler Co.
 - 5. Toto USA, Inc.
- C. Lavatory and Sink Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Standard America
 - 2. Kohler Co
 - 3. TOTO USA, INC
- D. Stainless Steel Sink Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eagle Group; Foodservice Equipment Division.
 - 2. Elkay Manufacturing Co.
 - 3. Griffin Products, Inc.
 - 4. Just Manufacturing
 - 5. Kohler Co
- E. Faucet Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Standard America.
 - 2. Chicago Faucets.
 - 3. Delta Commercial Faucets
 - 4. Eljer
 - 5. Kohler Co.
 - 6. Sloan Valve Company.
 - 7. T & S Brass and Bronze Works, Inc.
 - 8. WaterSaver
- F. Shower Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aqua Glass Corporation

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Clarion Bathware
 3. Florestone Products Co., Inc.
 4. LASCO Bathware
 5. Praxis Industries, LLC
 6. Sterling
 7. Swan Corporation (The)
- G. Water Outlet Box Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Halsey Taylor
 2. IPS Corporation/Guy Gray
 3. Oatey
- H. Drain Accessory (P-Traps, Strainers, Angle Stops, Escutcheons and Supplies) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brasscraft
 2. Chicago
 3. Dearborn
 4. EBC
 5. McGuire
 6. Zurn

2.3 WATER CLOSETS

- A. P-1 Water Closets: Floor-mounted, floor-outlet, tank-type.
1. Fixture:
 - a. American Standard H2Optimum® Model 288AA.114, vitreous china, siphonic action, elongated bowl, Right Height®, ultra-high efficiency toilet (UHET), 1.1 gallons per flush (4.2 Lpf), EverClean® antimicrobial surface, fully glazed 2" trapway, 12" rough-in, white.
 2. Toilet Seat:
 - a. Church No. 9500SSCT commercial heavy-duty, elongated rim, open front, less cover, white, stainless steel check-hinge with gasket. Shall comply with American Nation Standard Z124.5.
 3. Remarks:
 - a. Contractor shall verify and coordinate rough-in locations.
 - b. Installation shall meet the American with Disabilities Act guidelines and ANSI A117.1 Accessible and Usable Buildings and Facilities.

2.4 LAVATORIES

- A. P-2 Lavatories: Oval, self-rimming, counter mounted.
1. Fixture:
 - a. American Standard 0475.047 Aqualyn®, vitreous china, oval, self-rimming countertop lavatory, 20-3/8" x 17-3/8", center-hole faucet drilling, front overflow, white.
 2. Faucet:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Sloan Lino EAF-250-ITM, automatic-type, battery-powered, electronic-sensor-operated, nonmixing, solid-brass valve, single hole, 0.5 gpm, rigid spout, laminar flow outlet, 6-volt lithium CR-P2 commercial battery (3-year life), polished chrome finish with an integral ASSE 1070 valve. Time out setting for faucet shall be set for 12 seconds.
 3. Strainer:
 - a. McGuire 155-WC cast brass chrome plated offset wheelchair strainer with polished chrome cast brass elbow, 17 gauge 1-1/4 inch seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer. Offset lavatory strainer shall be in compliance with CSA or other recognized testing authority and bear both manufacturer and testing mark.
 4. Trap:
 - a. McGuire 8902C cast brass chrome plated 1-1/4" x 1-1/2" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.
 5. Supplies and Stops:
 - a. Chicago Faucets 1017-ABCP angle stop fitting with supply tube and loose key. 2-1/4" tee handle, tapered square broach, compression cartridge, 1/2 NPT female thread inlet, 3/8 NPT female compression outlet.
 6. Remarks:
 - a. Installation shall meet the American with Disabilities Act guidelines and ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - b. Contractor shall verify and coordinate rough-in locations.
- B. P-3 Lavatories: Rectangular, wall mounted.
1. Fixture:
 - a. American Standard Decorum® 9024.001EC, vitreous china, wall-hung lavatory, 20" x 18-1/4", center-hole faucet drilling, rear overflow, EverClean antimicrobial surface, white.
 2. Faucet:
 - a. Sloan Lino EAF-250-ITM, automatic-type, battery-powered, electronic-sensor-operated, nonmixing, solid-brass valve, single hole, 0.5 gpm, rigid spout, laminar flow outlet, 6-volt lithium CR-P2 commercial battery (3-year life), polished chrome finish with an integral ASSE 1070 valve. Time out setting for faucet shall be set for 12 seconds.
 3. Strainer:
 - a. McGuire 155-WC cast brass chrome plated offset wheelchair strainer with polished chrome cast brass elbow, 17 gauge 1-1/4 inch seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer. Offset lavatory strainer shall be in compliance with CSA or other recognized testing authority and bear both manufacturer and testing mark.
 4. Trap:
 - a. McGuire 8902C cast brass chrome plated 1-1/4" x 1-1/2" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.
 5. Supplies and Stops:
 - a. Chicago Faucets 1017-ABCP angle stop fitting with supply tube and loose key. 2-1/4" tee handle, tapered square broach, compression cartridge, 1/2 NPT female thread inlet, 3/8 NPT female compression outlet.
 6. Support:
 - a. Josam 17100 Series floor mounted lavatory support.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

7. Remarks:
 - a. Installation shall meet the American with Disabilities Act guidelines and ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - b. Contractor shall verify and coordinate rough-in locations.

2.5 SINKS

A. P-4 Kitchen Sink: Stainless steel, undermount.

1. Fixture:
 - a. Kohler Vault™ K-3838-3, premium 18-gauge stainless steel, Smart Divide® double-equal bowl kitchen sink, 33" x 22", undermount installation, 9" bowl depth, three faucet holes, 3-5/8" drain openings, stainless steel finish.
2. Faucet:
 - a. Chicago Faucets No. 201-G8AE2805F317AB, concealed deck-mount faucet with 8" fixed centers, rigid/swing gooseneck spout, 8" center-to-center, 0.5 GPM pressure compensating, non-aerating, laminar outlet, 4" vandal-proof wristblade handles, rebuildable compression cartridge.
3. Strainer:
 - a. McGuire 1151-WC cast brass chrome plated offset basket strainer with polished chrome cast brass elbow, 17 gauge 1-1/2 inch seamless brass offset tailpiece, heavy rubber basin washer and fiber friction washer. Offset basket strainer shall be in compliance with CSA or other recognized testing authority and bear both manufacturer and testing mark.
4. Food Waste Disposer:
 - a. InSinkErator Model Evolution Excel with multigrind plus and soundseal plus technologies, 1.0 HP motor, auto-reverse grind system, stainless steel grind chamber and components. Provide with power cord kit and sinktop switch (color to match countertop, submit for approval).
5. Trap:
 - a. McGuire 8912C cast brass chrome plated 1-1/2" x 1-1/2" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.
6. Supplies and Stops:
 - a. Chicago Faucets 1017-ABCP angle stop fitting with supply tube and loose key. 2-1/4" tee handle, tapered square broach, compression cartridge, 1/2 NPT female thread inlet, 3/8 NPT female compression outlet.
7. Remarks:
 - a. Installation shall meet the American with Disabilities Act guidelines and ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - b. Contractor shall verify and coordinate rough-in locations.

B. P-5 Mop Sink: Floor mounted, terrazzo.

1. Fixture:
 - a. Fiat Model TSB100, one piece, 24"x24" precast, ground and polished terrazzo with stainless steel caps.
2. Faucet:
 - a. Chicago Faucets No. 897-CP, wall mounted sink faucet for hot and cold water with 7-5/8" - 8-3/8" adjustable centers. Chrome plated, vacuum breaker spout with pail hook and wall brace. 2-3/8" metal, vandal-proof, lever handles with sixteen-point, tapered broach and secured blue and red

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

index buttons. Rebuildable compression cartridge, opens and closes 90°, closes with water pressure, features square, tapered stem. Adjustable supply arms shall include 1/2" NPT female union nut. 3/4" male hose thread outlet. Integral stop valves for servicing the faucet.

3. Strainer:
 - a. Fiat 1453-BB flat type stainless steel.
4. Remarks:
 - a. Fiat E-77-AA vinyl bumper guard, Fiat 889-CC mop hanger and stainless steel wall guards.
 - b. Install terrazzo mop basin on 1/2" layer of mortar per manufacturer's instructions.
 - c. Contractor shall verify and coordinate rough-in locations.

C. P-6 Autopsy Station:

1. Fixture:
 - a. MOPEC Model 1036-7A-AP floor mounted autopsy station, left sink, elevating made from 304 stainless steel with #4 satin finish. Unit shall be provided with hot/cold mixing faucet with wrist blade handles and gooseneck spout, specimen shelf, hydro aspirator with vacuum breaker and reverse flow, hand spray assembly with 10 foot flexible hose, perforated grid plates, LED vapor proof fixture, and GFCI receptacle.
2. Trap:
 - a. McGuire 8912C cast brass chrome plated 1-1/2" x 1-1/2" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.
3. Supplies and Stops:
 - a. Chicago Faucets 1017-ABCP angle stop fitting with supply tube and loose key. 2-1/4" tee handle tapered square broach, compression cartridge, 1/2" NPT female thread inlet, 3/8" compression outlet.
4. Remarks:
 - a. Contractor shall verify and coordinate rough-in locations.
 - b. Contractor shall coordinate plumbing utility connections with the owner-supplied equipment.

2.6 SHOWERS

A. P-7 Shower:

1. Fixture:
 - a. Clarion RE6036LSD/S, one-piece AcrylX™ alcove shower, 60" x 36" x 76-1/2", slip-resistant floor, molded seat, corner soap ledges, center drain, white finish.
2. Valve:
 - a. Symmons Temptrol Commercial Series #C-96-500-B30-V-X-CHKS-1.5 shower and hand shower system with pressure-balancing mixing valve with lever handle, integral service stops and adjustable stop screw to limit handle turn. Provide diverter with integral volume control. Wall/hand shower #EF-100 with 60" flexible metal hose, in-line vacuum breaker, wall connection and flange. 30" slide bar for hand shower mounting. Provide 1.5 gpm flow rate restrictor.
3. Shower Head:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Symmons Temptrol Commercial #4-137 cast brass adjustable spray shower head with arm and flange.
4. Drain:
 - a. Furnished with fixture.
5. Trap:
 - a. McGuire 8904 cast brass chrome plated 2" x 2" P-trap with cleanout with 17 gauge tubular wall bend, cast brass slip nuts. Trap shall be in compliance with CSA and bear both manufacturer and testing mark.
6. Remarks:
 - a. Installation shall meet the American with Disabilities Act guidelines and ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - b. Valve shall be compliant with ASME A112.18.1 and ASSE 1016 standards.
 - c. The hot limit safety stop shall be field adjusted to not exceed 120 degrees.
 - d. Contractor shall verify and coordinate rough-in locations.

2.7 EMERGENCY FIXTURES

- A. P-8 Emergency Eyewash: Deck mounted, swing down
 1. Fixture:
 - a. Guardian Equipment Model G1814 wall-mounted eyewash with stainless-steel bowl, 1/2-inch chrome-plated brass stay-open ball valve, powder-coated cast-aluminum flag handle, and wall bracket. Provide two polypropylene GS-Plus™ spray heads with integral flip-top dust covers, filters, and 1.6 GPM flow-control orifices mounted on a chrome-plated brass eyewash assembly. Provide ANSI-compliant identification sign..
 2. Emergency Thermostatic Mixing Valve:
 - a. Bradley Navigator EFX8 Model S19-2000 emergency thermostatic mixing valve, suitable for the minimum flow required by the eyewash fixture.
 3. Remarks:
 - a. Installation shall meet the American with Disabilities Act guidelines and ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - b. Contractor shall verify and coordinate rough-in locations.
 - c. Provide tepid water between 60°F and 100°F.

2.8 WATER OUTLET BOXES

- A. P-9 Ice Maker Outlet Box: Recessed.
 1. Fixture:
 - a. IPS Guy Gray Model MIB1HAAB water outlet box, 20 gauge box and 20 gauge faceplate, white powder coat on cold rolled steel finish, 1/4 turn ball valve with 1/2" sweat connection and hammer arrester.
 2. Remark:
 - a. Contractor shall verify and coordinate rough-in locations.
- B. P-10 Washer Outlet Box: Recessed.
 1. Fixture:
 - a. IPS Guy Gray T200 Series recessed center-drain washing machine outlet box, white powder-coated 20-gauge cold-rolled steel box with matching 20-gauge faceplate. Provide factory-installed quarter-turn hot and cold brass

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

ball valves with 1/2" sweat connections, integral water hammer arresters, and 2" PVC drain connection. Box shall have watertight sloped-bottom construction with knockouts on the top, bottom, and sides. Valves shall comply with ASME A112.18.1.

2. Remark:
 - a. Contractor shall verify and coordinate rough-in locations.

2.9 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Water-Closets:
 1. Water-Closet Installation:
 - a. Install level and plumb according to roughing-in drawings.
 - b. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
 - c. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
 2. Support Installation:
 - a. Install supports, affixed to building substrate, for wall-hung water closets.
 - b. Use carrier supports with waste-fitting assembly and seal.
 - c. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
 - d. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
 3. Install toilet seats on water closets.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

B. Lavatories:

1. Install lavatories level and plumb according to roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories.
3. All faucet handles, where possible, shall have color coded "indexes" identifying the service used.
4. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
5. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220700 "Plumbing Insulation."

C. Showers

1. Assemble shower components according to manufacturers' written instructions.
2. Install showers level and plumb according to roughing-in drawings.
3. Install ball valves on water-supply piping to each shower faucet.
4. Install shower flow-control fittings with specified maximum flow rates in shower arms.
5. Set shower receptors and shower basins in leveling bed of cement grout.

D. Sinks

1. Install sinks level and plumb according to roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-hung sinks.
3. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
4. Set floor-mounted sinks in leveling bed of cement grout.
5. Install water-supply piping with stop on each supply to each sink faucet.
 - a. Install stops in locations where they can be easily reached for operation.
 - b. Install check valves on water-supply piping serving mop sink faucets.
6. All faucet handles, where possible, shall have color coded "indexes" identifying the service used.
7. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220700 "Plumbing Insulation."

E. Emergency Fixtures:

1. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
2. Install fixtures level and plumb.
3. Fasten fixtures to substrate.
4. Install shutoff valves in water-supply piping to fixtures. Use locking ball valve if specific type valve is not indicated. Install valves locked in open position. Install valves in locations where they can easily be reached for operation.
5. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals.
6. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system.
7. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system.

F. Water Outlet Boxes:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs.
 - G. Wall Flange and Escutcheon Installation:
 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
 - H. Joint Sealing:
 1. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 2. Match sealant color to fixture color.
 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
 - I. Confirm operation of all electronic-sensor mechanisms. If hard-wired through transformers, test operation of electronic-sensor mechanisms prior to installing back-up batteries
 - J. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- ### 3.3 CONNECTIONS
- A. Connect fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match fixtures.
 - B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
 - C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
 - D. Where installing piping adjacent to fixtures, allow space for service and maintenance.
- ### 3.4 ADJUSTING
- A. Operate and adjust fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
 - B. Adjust water pressure at flushometer valves to produce proper flow.
 - C. Adjust detection range and flow duration for all electronic-sensor mechanisms.
- ### 3.5 CLEANING AND PROTECTION
- A. Clean fixtures and fittings with manufacturers' recommended cleaning methods and materials.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Install protective covering for installed fixtures and fittings.
- C. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 226813 - FACILITY NATURAL-GAS PIPING

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. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Manual gas shutoff valves.
 - 5. Motorized gas valves.
 - 6. Earthquake valves.
 - 7. Pressure regulators.
 - 8. Service meters.
 - 9. Dielectric fittings.
 - 10. Emergency gas valve cabinet.

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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - 5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars and supports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

6. Dielectric fittings.

- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Shop Drawing Scale: 1/4 inch per foot.
 - 2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.
- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For motorized gas valves, pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Steel Support 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.
- C. 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.

1.8 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 to prevent entrance of dirt, debris, and moisture.
- B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- C. Protect stored PE pipes from direct sunlight.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.9 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Owner no fewer than ten days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: 10 psig.
- B. Natural-Gas System Pressure within Buildings: As indicated on the drawings. Not more than 5 psig.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. All pipe and fittings shall be from a United States domestic manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.3 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Steel Pipe Nipples: ASTM A733, made of same materials and wall thicknesses as pipe in which they are installed.
 - 6. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. PE Pipe: ASTM D 2513, SDR 11.
 - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or flanged or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.4 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
 - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 - 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 - 4. Corrugated stainless-steel tubing with polymer coating.
 - 5. Operating-Pressure Rating: 0.5 psig.
 - 6. End Fittings: Zinc-coated steel.
 - 7. Threaded Ends: Comply with ASME B1.20.1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

8. Maximum Length: 60 inches

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.5 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.6 MANUAL GAS SHUTOFF VALVES

- A. See "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Tamperproof Feature: Locking feature for valves indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. A.Y. McDonald Mfg. Co.
 - b. Apollo Flow Controls; Conbraco Industries, Inc.
 - c. BrassCraft Manufacturing Co.; a Masco company
 - d. Lyall, R. W. & Company, Inc
 - e. Perfection Corporation
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Lee Brass Company
 2. Body: Bronze, complying with ASTM B 584.
 3. Plug: Bronze.
 4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Valve Boxes:
1. Cast-iron, two-section box.
 2. Top section with cover with "GAS" lettering.
 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
 4. Adjustable cast-iron extensions of length required for depth of bury.
 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.7 EARTHQUAKE VALVES

- A. Earthquake Valves, Maximum Operating Pressure of 5 psig: Comply with ASCE 25.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Vanguard Valves, Inc

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig.
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

2.8 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris
 - b. American Meter Company
 - c. Fisher Control Valves & Instruments; a brand of Emerson Process Management
 - d. Itron Gas
 - e. Richards Industries
 - f. Sensus
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris
 - b. American Meter Company

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Eclipse Innovative Thermal Technologies
 - d. Fisher Control Valves & Instruments; a brand of Emerson Process Management
 - e. Itron Gas
 - f. Maxitrol Company
 - g. Richards Industries
 - h. Sensus
 - 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 3. Springs: Zinc-plated steel; interchangeable.
 - 4. Diaphragm Plate: Zinc-plated steel.
 - 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - 6. Orifice: Aluminum; interchangeable.
 - 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 - 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - a. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 - 12. Maximum Inlet Pressure: 5 psig.
- D. Appliance Pressure Regulators: Comply with ANSI Z21.18.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton
 - b. Harper Wyman Co
 - c. Maxitrol Company
 - d. SCP, Inc
 - 2. Body and Diaphragm Case: Die-cast aluminum.
 - 3. Springs: Zinc-plated steel; interchangeable.
 - 4. Diaphragm Plate: Zinc-plated steel.
 - 5. Seat Disc: Nitrile rubber.
 - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 - 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 - 9. Maximum Inlet Pressure: 1 psig.

2.9 SERVICE METERS

- A. Diaphragm-Type Service Meters: Comply with ANSI B109.1 (500 cfh and less) and ANSI B109.2 (more than 500 cfh).
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Actaris
- b. American Meter Company
- c. Invensys
- d. Itron Gas
2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Compensation: Continuous temperature.
7. Meter Index: Cubic feet.
8. Meter Case and Index: Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig.
11. Pressure Loss: Maximum 0.5-inch wg.
12. Accuracy: Maximum plus or minus 1.0 percent.

2.10 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 shall not be used. In lieu of dielectric union, use an approved brass fitting.

2.11 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 INSTALLATION OF OUTDOOR PIPING

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 24 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 24 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer, or replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage downstream from each service regulator.

3.4 INSTALLATION OF INDOOR PIPING

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Do not install piping in concealed locations unless sleeved with the sleeve open at both ends.
- E. 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.
- F. Where installing piping above accessible ceilings, allow sufficient space for ceiling panel removal.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- G. Locate valves for easy access. Do not locate valves within return air plenums.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
 - 2. Install sediment trap on both sides of regulators for gas reduction to 2 psig with valve and capped.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 5. Prohibited Locations:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Section 220519 "Meters and Gauges for Plumbing Piping."
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 INSTALLATION OF SERVICE-METER ASSEMBLIES

- A. Install service-meter assemblies aboveground, on concrete bases.
- B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.

3.6 INSTALLATION OF VALVES

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.
- F. Do not install valves in return-air plenums.

3.7 PIPING 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. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. 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.
- D. Welded Joints:
 - 1. Construct joints in accordance with AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.8 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment " for hangers, supports, and anchor devices.
- C. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.9 PIPING CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous and bonded to gas-appliance equipment grounding conductor of the circuit powering the appliance in accordance with NFPA 70.
- C. Where installing piping adjacent to appliances, allow space for service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

3.10 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.11 PAINTING

- A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (flat).
 - d. Color: Gray.
- B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd (flat).
 - d. Color: Gray.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Provide minimum 48 hours notice prior to testing to allow the Architect, Engineer, Commissioning Agent, Owner or his representative the opportunity to attend.

3.13 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.14 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be one of the following:
 1. NPS 3/4 through 2: Steel pipe with malleable-iron fittings and threaded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE

- A. Aboveground, piping shall be one of the following:
 1. NPS 3/4 through 2: Steel pipe with malleable-iron fittings and threaded joints.
- B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- C. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 1. NPS 2 and Smaller: Bronze plug valves.

3.17 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.

END OF SECTION 226813

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 230500 - COMMON WORK RESULTS FOR MECHANICAL

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. This Section describes the common work requirements for the mechanical work included in Division 23 and applies to all sections of Division 23.
- B. Related Sections:
 - 1. Section 013150 "Coordination Drawings" for coordination drawing requirements.

1.3 DEFINITIONS

- A. Following are definitions of terms and expressions used in the Mechanical and Electrical Sections:
 - 1. Provide: Furnish and install
 - 2. Directed: Directed by the Architect or Engineer
 - 3. Indicated: Indicated in Contract Documents
 - 4. Concealed: Hidden from normal sight; includes items within furred spaces, pipe and duct shafts, above suspended ceilings and within return air plenums.
 - 5. Exposed: Non-concealed - Work within Equipment Rooms shall be considered exposed.
 - 6. Exterior: Items being or situated outside. Items located within a crawl space shall be considered exterior.
 - 7. Conditioned: Heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means, so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.
 - 8. Piping: Includes pipes, fittings, valves, hangers, and accessories comprising a system.
 - 9. Ductwork: Includes ducts, fittings, housings, dampers, hangers, air devices, and accessories comprising a system.
 - 10. Architect: Principal design professional for the project. In certain types of projects, the principal design professional may be an engineer rather than an architect. For such projects, within the bounds of these specifications, where the term "architect" is used, it may refer instead to the engineer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 CODES, REGULATIONS, AND PERMITS:

- A. References to codes, standards, specifications, and regulations apply to the latest edition adopted by the jurisdiction where the project is located.
- B. All materials furnished and all work installed shall comply with the applicable rules, regulations, and recommendations of the following bodies:
 - 1. International Building Code
 - 2. International Existing Building Code
 - 3. International Mechanical Code
 - 4. International Plumbing Code
 - 5. International Fire Code
 - 6. International Energy Code
 - 7. National Electric Code
 - 8. National Fire Protection Association Standards
 - 9. State Fire Marshal Regulations
 - 10. Local Fire Marshal Regulations
 - 11. ASHRAE Standards and Handbooks (Latest Editions)
 - 12. Local Health Department
 - 13. State Health Department
 - 14. Local Utility Companies
 - 15. Underwriters Laboratories
 - 16. Owner's Insurance Underwriter Standards
 - 17. Environmental Protection Agency
- C. Give all necessary notices, obtain all permits, and pay all fees and other costs, including those for utility connections or extensions in connection with the work. File all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction. Obtain all required certificates of inspection and deliver same to the Architect before request for acceptance and final payment for the work.

1.5 SUBMITTAL MANAGEMENT AND REVIEW CAPACITY

- A. Refer to Section 013300 "Submittal Procedures" for additional information on scheduling, coordination and procedures.
- B. Submittal Schedule
 - 1. Submittals shall be transmitted in accordance with the approved Submittal Schedule. Submittals that deviate substantially from the approved schedule may be deferred and reviewed based on available review capacity.
- C. Submittal Packaging and Coordination
 - 1. Submittals shall be prepared and transmitted as complete, coordinated packages organized by individual Specification Sections.
 - 2. Each submittal package shall:
 - a. Include all supporting product data, shop drawings, schedules, calculations, and coordination information required for review.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Bear the Contractor's review and approval stamp confirming coordination with other Work of the Contract and for compliance with the Contract Documents.
- 3. Submittals that are incomplete, improperly formatted, uncoordinated, or lacking the Contractor's approval stamp may be returned without review. In such cases, the review period shall not commence until a complete and acceptable submittal package is received.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For mechanical HVAC systems and specialties to include in emergency, operation, and maintenance manuals.
- B. HVAC Submittals/Shop Drawings.
- C. HVAC System Warranties.
- D. HVAC Controls Diagrams with Detailed Sequence of Operations.
- E. HVAC Testing, Adjusting and Balancing Report.

1.7 EQUIPMENT LIST

- A. Provide a spreadsheet list of all equipment provided with the drawing tag number or designation, name, manufacturer, model number, serial number and full electrical characteristics.
- B. This list shall be provided to the TAB agent, Commissioning Agent, BAS providers and to the Owner prior to beginning TAB work and as soon after all equipment is received on site.

1.8 EQUIPMENT START-UP AND INITIAL OPERATION

- A. No equipment shall be operated, for testing or trial use, before full compliance with the equipment manufacturers' specifications and instructions for the lubrication, alignment, direction of rotation, balance, and other applicable considerations.
- B. Particular care shall be taken to see that all equipment is completely assembled, properly lubricated, and all grease and oil cases and reservoirs have been filled to the correct level with the recommended lubricants.
- C. It is the Contractor's responsibility to place each item of equipment, installed by him, in operating condition. This responsibility includes all auxiliaries, piping, wiring, etc., the start up of each unit, and a check of its performance.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.9 PROTECTION

- A. Protect ductwork, piping and equipment 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" for an advanced level of duct cleanliness.
 - 1. Open ends on stored, completed and in-progress work, as well as overnight work-in-progress, shall be sealed.
 - 2. Protective coverings shall only be removed immediately before installation of new work, and inspected to determine if additional wipe down is necessary.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Refer to Section 017900 "Demonstration and Training" for additional information.
- B. Upon completion of all work and all tests, Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment.
- C. Contractor shall instruct the Owner's representative fully in the operation, adjustment, and maintenance of all equipment furnished.

1.11 SITE VISIT

- A. Prior to preparing the bid, it is recommended that the Contractor and subcontractors shall visit the site and familiarize themselves with all existing conditions, make all necessary investigations as to locations of utilities, and all other matters which can affect the work.
- B. No additional compensation will be made to the Contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.12 DRAWINGS

- A. The Contract Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Any offsets, rises, or transitions not shown on the drawings and required to provide a complete system shall be provided at no additional contract cost. Do not scale the drawings. Consult the Architectural and Structural drawings and details for exact location of structure and equipment; where same are not definitely located, obtain this information from the Architect.
- B. In the event of ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of work, or 2) comply with the more stringent requirement. Either or both in accordance with the Architect's interpretation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.13 ELECTRICAL WORK

- A. Under Division 23 MECHANICAL, provide the following items of electrical work which shall conform with the applicable requirements of the Electrical Division:
 - 1. Class 2 (24VAC or less) temperature control wiring.
 - a. Concealed wiring shall be installed in conduit.
 - b. Concealed, inaccessible wiring shall be installed in conduit and routed to above nearest accessible ceiling.
 - c. Concealed, accessible wiring does not need to be installed in conduit but shall be plenum rated.
 - d. Exposed wiring shall be installed in conduit.
 - e. Refer to Section 260533 - Raceways and Boxes for Electrical Systems for installation requirements.
 - f. Refer to Section 260533 - Raceways and Boxes for Electrical Systems for installation requirements.
 - 2. Interlock wiring for mechanical equipment and devices.
 - 3. IT/network cabling between the BAS and Owner/Agency IT network.
- B. Under Division 26 ELECTRICAL, provide:
 - 1. Power wiring, complete from power source to motor or equipment junction box, including power wiring through motor starters, power factor correction devices, and line reactors. Power factor correction devices shall be provided under Division 23 and installed under Division 26.
 - 2. Motor control centers or motor starter, panelboards.
 - 3. All miscellaneous individual motor starters, unless noted or specified otherwise.
- C. Variable frequency drives will be furnished and set in place under Division 23. Power wiring shall be provided under Division 26.

1.14 SINGULAR NUMBER

- A. Where any device or part of equipment is herein referred to in the singular number (such as "valve"), such reference applies to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to Section 013300 "Submittal Procedures" for additional information.
- B. For each specified product, provide from single manufacturer. Do not mix and match various manufactures for a single product. If various manufacturers are required for a single product, indicate reason and locations where each will be installed.
- C. All component parts of each items of equipment or device shall bear the manufacturers' name plate; giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate the maintenance or

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

replacement. The name plate of a subcontractor or distributor will not be acceptable. Where Underwriters' Laboratories standards apply, material and equipment shall be approved by them and shall bear the UL Label.

- D. In specifying materials, three (3) general procedures are used. The three (3) classifications are as follows:
 - 1. GROUP 1: When a material or equipment is specified by brand name or other identifying information and three (3) or more brands are named it is considered that any one (1) of the brands so named will perform as desired, and the Contractor shall base his proposal on one (1) of the named brands. The first brand named or identified basis of design shall be used as a standard. The other brands named shall be equal to the specified brand in all respects. If one (1) of the other brands named is used it shall be the Contractor's responsibility to verify proper clearances and fit of the substituted equipment.
 - 2. GROUP 2: When the material or equipment is specified with the phrase "...or approved equal..." after a brand name and other identifying information, it is intended that the brand name is used for the purpose of establishing a minimum acceptable standard of quality and performance and Contractor may base his bid proposal on any item which is in all respects equal to that specified and presents essentially the same appearance. It shall be the Contractor's responsibility to ensure proper fit and clearances of all substituted equipment.
 - 3. GROUP 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, American Society of Testing and Materials, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects to the referred "Standard Specification".
- E. It is distinctly understood: (1) that the Architect will use his own judgment in determining whether or not any materials, equipment or methods offered in substitution are equal to those specified; (2) that the decision of the Architect on all such questions of equality is final; and (3) that all substitutions will be made at no increase in cost to the Owner.
- F. Upon receipt of written approval from Architect, Contractor may proceed with substitution providing Contractor assumes full responsibility for, and makes, at his own expense, any changes or adjustments in construction or connection with other work that may be required by the substitution of such materials, equipment or methods. In the event of any adverse decisions by the Architect no claim of any sort shall be made or allowed against the Owner.
- G. All pipe and fittings shall be from a United States domestic manufacturer.

2.2 INSTALLATION AND COORDINATION DRAWINGS

- A. General
 - 1. Prior to fabricating or installing work, the contractor shall prepare, submit and use composite installation and coordination drawings to assure proper coordination and installation of work. No installation or construction work shall begin until the coordination drawings are completed, submitted, and approved.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems. Composite coordination drawings shall include new and existing elements, components, and systems.
3. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended.
4. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important to efficient flow of Work.
5. Consideration shall be made for scheduling, sequencing, movement, and positioning of large equipment into building during construction.
6. Indicate penetrations in floors, walls, and ceilings and their relationship to assembly construction, other penetrations and installations. Identify where additional bracing and offsets are required to comply with Contract Documents.
7. Indicate any required installation sequences to minimize cutting and patching.
8. Indicate all equipment and devices indicated on wiring diagrams and schematics. Where field connections are shown to factory-wired terminals include manufacturer's literature showing internal wiring
9. Coordination Drawing Organization: Organize coordination drawings as follows:
 - a. Underslab Plans: Show structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work.
 - b. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the work.
 - c. Roof Plan: Show architectural and structural elements, and mechanical, plumbing, fire-protection, and electrical work. Indicate penetrations and openings required for all disciplines.
 - d. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical, electrical, plumbing and fire protection components, and related work. Locate components within ceiling plenum to accommodate architectural ceiling height and layout of light fixtures indicated on Drawings.
 - e. Mechanical Rooms: Show plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment and piping.
 - f. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - g. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
10. Systems: Include, but do not necessarily limit to, the following:
 - a. HVAC:
 - 1) All equipment and equipment bases.
 - 2) Size and bottom elevations of horizontal ductwork, including insulation, bracing, flanges, and support systems.
 - 3) Size and horizontal elevations of vertical ductwork, including insulation, bracing, flanges, and support systems.
 - 4) Ductwork, grilles, registers, diffusers, dampers, access panels,

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 5) Maintenance clearances (including tube and filter removal), insulation installation clearances
- 6) Any item that may impact coordination with other disciplines.
- b. HVAC Piping:
 - 1) All equipment and equipment bases.
 - 2) Size and bottom elevations of horizontal piping, including insulation, bracing, flanges, and support systems. Notate code required slope elevations.
 - 3) Size and horizontal elevations of vertical piping, including insulation, bracing, flanges, and support systems.
 - 4) Connections to equipment, valve and trim locations, access panels.
 - 5) Maintenance clearances, valve steam clearances, insulation installation clearances
 - 6) Any item that may impact coordination with other disciplines.
- c. Plumbing:
 - 1) All equipment and equipment bases.
 - 2) Size and bottom elevations of horizontal piping, including insulation, bracing, flanges, and support systems. Notate code required slope elevations.
 - 3) Size and horizontal elevations of vertical piping, including insulation, bracing, flanges, and support systems.
 - 4) Connections to equipment, valve and trim locations, access panels.
 - 5) Maintenance clearances, valve steam clearances, insulation installation clearances
 - 6) Any item that may impact coordination with other disciplines.
- d. Electrical and Specialty Systems:
 - 1) Runs of vertical and horizontal conduit 1-1/2 inches in diameter and larger and racks of smaller conduit are required.
 - 2) Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - 3) Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - 4) Location of pull boxes and junction boxes, dimensioned from column center lines.
 - 5) Any item that may affect coordination with other disciplines.
- e. Framing: All king studs, headers, bracing, miscellaneous framing, and any items that may affect coordination with other disciplines.

B. Production of Coordination Drawings

1. Draw plans to a scale not less than 1/4 inch equals one (1) foot in AutoCAD or REVIT format. Include plans, sections, and elevations of proposed work. Dimension all work as specified and as required for coordinated installation.
2. Reproduction of any portion of the mechanical and electrical contract drawings for re-submittal as a shop drawing is strictly prohibited. Shop drawings produced in such a manner will be rejected and returned not reviewed. Installation and coordination drawings shall be to scale reflecting actual equipment sizes purchased for the project.
3. The Construction Manager shall obtain and provide in AutoCAD or REVIT the base background documents to each contractor to establish a common platform for each contractor to use for their design drawings. Coordination will be accomplished by each Contractor superimposing his work on drawings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Contractor coordination meetings shall be held continuously until the coordination drawings are complete and approved by all parties. Meetings shall be scheduled as required to complete the drawings in a timely manner as to not impact the project schedule. Additional time or compensation shall not be awarded based on the complexity or effort required to complete the coordination drawings.
5. In the event of conflicts involving location and layout of work, unless otherwise directed the Construction Manager shall use the following priority to resolve the conflict:
 - a. Structure and partitions shall have highest priority.
 - b. Equipment locations and access
 - c. Ceiling systems and recessed light fixtures.
 - d. Gravity drainage lines.
 - e. Medium pressure ductwork and devices.
 - f. Large pipe mains, valves and devices.
 - g. Pneumatic tube and material conveying systems (where applicable)
 - h. Low pressure ductwork, diffusers, registers, grilles, dampers
 - i. Fire protection piping, devices and heads.
 - j. Small piping, tubing, electrical conduit and devices. Conduits installed in corridors shall be maintained at least 6-9" above finished ceiling and similarly grouped and tightly spaced.
 - k. Access panels.
6. Any conflicts, etc., discovered in the coordination stages prior to Contractor(s) sign-off which cannot be resolved by the Contractor(s) shall be brought to the Architect's attention for resolution.

C. Submittals

1. Submit drawing files using Portable Data File (PDF) format. Include transmittal indicating that each specialty trade has signed-off on each submitted coordination drawing.
2. For each area, submit:
 - a. Composite overlay drawing of each area with all trades shown.
 - b. Individual trade drawing of each area, i.e. Reflected Ceiling Plan, HVAC Ductwork, HVAC Piping, Plumbing, Fire Protection, Electrical.
3. Consultant will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Consultant determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Consultant will so inform Contractor, who shall make changes as directed and resubmit.
4. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with architectural, structural, mechanical, electrical and other work.
5. Contractor is responsible for timely updates to the coordination drawings to indicate as-built conditions for their own work. Updates are required to include all changes regardless of the source or reason for the change, including changes initiated by the Owner, Architects or Engineers.

D. Installation

1. Any conflicts, etc., discovered after the created and submission of the coordination and installation drawings and during the installation of the Work will be the responsibility of the Contractor(s) to resolve with the approval of Architect.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

Any and all costs for these resolutions shall be solely the responsibility of the Contractor(s).

2. Work fabricated/installed prior to the completion of the coordination and installation drawings is performed at the Contractors own risk, and compensation of time/costs for corrections will not be awarded.
3. Any work installed that is not in conformance with final approved coordination and installation drawings shall be required to be removed and relocated, and compensation of time/costs for corrections will not be awarded.

2.3 FIRE-RATED PENETRATIONS

- A. Provide UL Listed fire penetration systems in openings in rated floors, walls, and other elements of construction. Provide UL listed fire penetration systems at all new and existing pipe penetrations of new and existing rated construction within the area of work. Coordinate work of this section with all other trades necessary for the proper installation of the fire rated penetration systems.
- B. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications. Submit copies of manufacturer's specifications, recommendations, inspection requirements, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
- C. All fire penetration systems shall reference ASTM E814/UL 1479 - Fire Test of Through - Penetration Fire Stops.
- D. All systems shall be UL tested and listed in the UL Fire Resistance Directory.
- E. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one (1) year from date of substantial completion.
- F. 3M products have been specified as the penetration fire stop basis of design. Other manufacturer's systems are acceptable providing they meet the requirements set forth in this specification. The fire rated penetration systems shall be the products of one manufacturer to the maximum extent possible. The products of more than one manufacturer shall not be used as a combined seal.
- G. Provide materials classified by UL to provide fire stopping equal to time rating, both "F" and "T" ratings, of construction being penetrated. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814. Systems shall be smoke and air tight.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- H. Deliver material undamaged in manufacturer's clearly labeled, unopened containers identified with brand, type, grade, and UL label where applicable. Coordinate delivery with scheduled installation date to allow minimum storage time at site. Store material in clean, dry ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instruction.
- I. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- J. Furnish adequate ventilation if using solvent. Furnish forced air ventilation during installation if required by manufacturer. Keep flammable materials away from sparks or flame. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping resistance.
- K. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose, materials, rust, or other substances that may affect proper fitting, adhesion of the required fire resistance.
- L. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instructions. Seal holes or voids made by penetrations to ensure an effective smoke barrier. Where floor openings without penetrating items are more than four (4) inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor. Protect materials from damages on surfaces subject to traffic.
- M. Clean up spills of liquid components. Neatly cut and trim materials as required. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- N. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by local inspectors and other trades.

2.4 DRIVES FOR MACHINERY

- A. Equip each motor driven machine with a V-belt drive except those which are specified as direct drive. Where factory designed and assembled belt drives which do not conform to the following are proposed to be furnished, such non-conformity must be noted on the shop drawings submittals and may be cause for rejection of the item.
- B. Provide OSHA approved guards, for all belt drives, constructed in accordance with SMACNA standards. Submit shop drawings for approval.
- C. Select each drive according to the ratings and recommendations of the manufacturer for the service with which used, giving proper allowance for sheave diameter, center distance, and arc of contact less than one hundred eighty degrees. Size the motor driving a pump or fan to have a nameplate rating of not less than ten (10) percent above the total of actual brake horsepower and drive loss at specified capacity.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Belts shall be constructed of endless reinforced cords of long staple cotton, nylon, rayon, or other suitable textile fibers imbedded in rubber. Use belt with correct cross section to fit properly the sheave grooves. Carefully match belts for each drive.
- E. Provide any changes to the sheaves, belts, pulleys or drive package to obtain specified airflow.
- F. Select the motor of a capacity needed to operate the equipment at the specified mid-position operating condition. Where non-overloading motors are specified, select the motor capacity rating at the most closed position of the motor sheave. In no case shall motors be a smaller size than those indicated on the drawings.
- G. Do not select fan sheave smaller in diameter than thirty (30) percent of the fan wheel diameter.
- H. Construct sheaves of cast iron or steel, bored to fit properly on the shafts, and secured with key ways of proper size (not set screws). Key ways may be omitted for sheaves having 1/2 inch or smaller bores where set screws may be used.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. The quality of workmanship required, for each trade, in the execution of work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Architect and his decision as to acceptable quality is final.
- B. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.2 EQUIPMENT PERFORMANCE

- A. All equipment, devices, controls, and hardware shall be proven to operate successfully throughout the guarantee period. Systems shall be proven during all-weather seasons and be demonstrated to affect the design conditions at times. System components or equipment items that fail to consistently deliver the design conditions shall be removed and replaced as directed by the Architect. The cost of required equipment replacements shall be borne by the Contractor.
- B. All equipment shall be tested after installation and be proven to deliver the manufacturers quoted design capacity. When capacity is in question as deemed by the Architect, the Contractor shall perform a detailed and comprehensive field performance test to certify the equipment capacity. System effect or installed performance factors may not be applied to performance ratings unless they were previously included when the equipment was submitted for approval. Equipment that

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

fails to deliver manufacturers quoted design capacity shall be removed and replaced at the Contractors expense.

- C. Workmanship proven to be of poor quality or unsatisfactory in the commissioning phase of the project as deemed by the Architect shall be removed and replaced to the satisfaction of the Architect.

3.3 EQUIPMENT CONNECTIONS

- A. All equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, piping specialties, water seals, valves, and electric connections recommended by the manufacturer, required by code or required for proper operation shall be provided.

3.4 CUTTING AND PATCHING

- A. Cutting and patching associated with the work shall be performed in a neat and workmanlike manner. Existing surfaces, which are damaged by the Contractor, shall be repaired or provided with new materials. All patching shall be done with materials and methods similar to existing adjacent work, subject to approval of the Architect. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by reciprocating or rotary, non-percussive methods.
- B. Patching of areas disturbed by installation of new work shall match existing adjacent surfaces in material, texture, and color.

3.5 PROTECTION OF EXISTING WORK

- A. When working in and around the building, extreme care shall be exercised with regard to protection of the structure and mechanical services. Repair or replace, to the satisfaction of the Architect, any existing work damaged in the performance of the new work.

3.6 SURVEYS AND MEASUREMENTS

- A. Base all measurements (both horizontal and vertical) from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check correctness of same as related to the work. Verify locations of existing utilities and inverts of same prior to the start of any systems shown connecting to existing utilities.
- B. Should the Contractor discover any discrepancy between actual measurements or conditions, and those indicated, which prevent following good practice or the intent of the drawings and specifications, he shall notify the Architect and shall not proceed with his work until he has received instruction from the Architect.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.7 WELDING

- A. Welding shall conform to current standards and recommendations of the National Certified Pipe Welding Bureau, with all South Carolina Occupational Safety and Health Acts, State, City and County Fire Prevention Code Requirements, and NFPA Standard 241 including provision of appropriate portable fire extinguishers.
- B. Before assigning any welders to work covered by this specification, the Contractor shall provide the Architect with the names of pipe welders to be employed for the work, together with each welder's assigned number, letter, or symbol which shall be used to identify the work of that welder and which shall be affixed immediately upon completion of each weld. Contractor shall also submit, with the list of names, copies of each welder's certified qualification tests prescribed by the National Certified Welding Bureau or by other reputable testing laboratory using procedures covered in the American Society of Mechanical Engineers Building Construction Code, Section IX, "Qualification Standard Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators". Welders must be certified for all positions.
- C. If requested by the Architect, the Contractor shall submit identifying stenciled test coupons made by any welder in question. The Contractor shall require any welder to retake the tests when, in the opinion of the Architect, the work of the welder creates a reasonable doubt as to his proficiency. Tests, when required, shall be conducted at no additional expense to the Owner; and the welder in question shall not be permitted to work as a welder on this project until he has been recertified. Recertification of the welder shall be made to the Architect only after the welder has taken and passed the required test; welder must pass the test without benefit of retests in order to resume work as a welder on this project.
- D. Welding shall conform to the ANSI Code for Pressure Piping ANSI B31.9, Building Services Piping. The Contractor shall be responsible for the quality of welding and shall repair or replace any work not in accordance with these specifications. Contractor shall, without cost to the Owner, check welds by radiograph, ultrasonic testing, sectioning or a combination of these methods wherever there is a question raised by the Architect as to the quality of a weld. Examination of the questionable weld shall be in addition to other system tests specified. Welds shall have penetration complete to the inside diameter of the pipe. The recommended spacing and levels between ends of pipes prior to welding shall be used in all cases to assure full penetration.
- E. Welders on pressure piping shall be certified and carry their identification stamp with them. Welds on lines with operating pressures above 100 psig shall be stamped.

3.8 HANDLING AND STORAGE OF MATERIAL

- A. Proper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment and materials so that no equipment or materials are damaged.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. All equipment delivered to the job site shall be stored on pedestals, above the ground and under roof or other approved covering. All enclosures for equipment shall be weatherproof. All motors, drives, switchgear, panels, etc. which are not totally enclosed, that are involved in the work, shall be stored in a heated, dry, water protected area with a minimum temperature of fifty degrees (50) Fahrenheit. All valves shall be stored under roof on wood pedestals, above ground. All insulation shall be stored under roof or in trailers, adequately protected from the weather. The Contractor shall follow all written instructions and recommendations of the manufacturer and all requirements of the Architect in oiling, protection and maintenance of equipment during storage. It shall be the Contractor's complete responsibility for the storage and care of the equipment and materials.
- C. If any equipment and/or materials are found to be in poor condition at the time of installation the Architect may, at his discretion, order the Contractor to furnish and install new equipment and/or material at no cost to the Owner.

3.9 COOPERATION WITH OTHER TRADES

- A. Mechanical trades shall give full cooperation to other trades and shall furnish in writing, with copies to Architect any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay. Exact location of all mechanical and equipment, devices, etc. in finished spaces shall be coordinated with Architectural reflected ceiling plans, elevations and details.

3.10 CLEANING AND PAINTING

- A. Thoroughly clean all exposed surfaces of equipment and material and leave in a neat, clean condition.
- B. Restore and touch-up factory finishes which have been damaged during construction.
- C. For areas of exposed rust, treat with water-based emulsion chemical rust converter. Brush, roll, or spray on the surface to be treated and allow to cure prior to paint/surface touch-up. Basis of design is Ultra Last CuRUST Chemical Rust Converter.

3.11 ACCESSIBILITY

- A. Equipment shall be installed per manufacturer's recommended clearance guidelines with sufficient space for maintenance personnel service, operate, and maintain equipment.
- B. Locate all above ceiling equipment which must be serviced, operated, or maintained, in fully accessible positions to eliminate the need for access panels and doors. Equipment shall include, but not be limited to, valves, clean-outs, motors, controllers, dampers, drain points, etc.
- C. Where overhead equipment cannot be located above spaces with either no ceilings or removable acoustical ceiling tiles, contractor shall provide, as part of the contract and

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

no expense to the Owner, fourteen (14) gauge painted steel access doors where required and/or where directed (color shall match ceiling).

1. Access doors shall be Milcor or approved equal to suit material in which installed.
2. Access doors installed in fire rated walls or shafts shall be labeled and shall match rating of the construction.
3. Doors shall be of sufficient size to allow access to all components; minimum size shall be eighteen (18) inches by eighteen (18) inches.
4. Doors in Toilet Rooms and Janitor's Closets shall be Type 304 stainless steel.
5. All doors shall have cylinder locks operable from same key.
6. Submit shop drawings for approval. Locations shall be coordinated with the Architect and indicated on the composite installation and coordination drawings

- D. Equipment deemed inaccessible by the Architect shall be reworked by the Contractor at no expense to the Owner.

3.12 EXCAVATION AND BACKFILL:

- A. Refer to Section 312000 "Earth Moving" for additional requirements.

B. Definitions:

1. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - a. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - b. Final Backfill: Backfill placed over initial backfill to fill a trench.
2. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
3. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
4. Fill: Soil materials used to raise existing grades.
5. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
6. Utilities: On-site underground pipes, as well as underground services within buildings.

C. Soil Materials:

1. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter
2. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
 - a. Unsatisfactory soils include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
3. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M;

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
4. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
 5. Sand: ASTM C 33/C 33M; fine aggregate.
- D. Excavation for Utility Trenches:
1. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - a. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe unless otherwise indicated.
 - a. Clearance: 12 inches each side of pipe.
 3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes on solid, undisturbed earth for the full length of each pipe, except for that portion at the bell holes. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - d. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
 4. Any part of the trench bottom excavated below the specified subgrade shall be backfilled, at the Contractor's expense, with bedding course materials.
 - a. For utility trenches, compact bedding course soil material at 95 percent.
 5. Whenever wet, or otherwise unstable, subgrade is encountered below the elevation of the original ground surface which existed prior to the time of construction, such soil shall be removed to the depth and extent direct by the Architect and the trench backfilled to the proper grade with bedding material as hereinafter specified. Reimbursement for extra work performed by the Contractor shall be in accordance with the General Conditions.
 6. Provide shoring and sheet piling necessary for excavation and for the safety of personnel and property as directed. Unless otherwise directed, the sides of all excavations over four (4) feet deep must be braced. All shoring, bracing, sheet piling, etc., must be solidly installed heavy timber suitable for the purpose. No lumber shall be buried when excavations are backfilled, except by authority of the Architect.
- E. Subgrade Inspection
1. Notify Architect when excavations have reached required subgrade.
 2. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.
- F. Utility Trench Backfill:
1. No backfill and/or bedding shall be placed until the construction adjacent thereto or the utility to be backfilled has been inspected, tested and approved. Notify the Architect when inspections are required.
 2. Place backfill and beddings on subgrades free of mud, frost, snow, or ice.
 3. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes.
 4. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03.
 5. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03.
 6. Backfill voids with satisfactory soil while removing shoring and bracing.
 7. Initial Backfill:
 - a. Soil Backfill: Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe.
 - 1) Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping to avoid damage or displacement of piping.
 - 2) Backfill for plastic pipe shall be clean sand, free of foreign materials.
 - 3) Coordinate backfilling with utilities testing.
 8. Final Backfill:
 - a. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
 9. Whenever the Architect requires the removal of wet or otherwise unstable subgrade from the fill material previously placed by the Contractor, the cost of all removal of unstable soil, together with backfilling of the trench as herein specified shall be borne by the Contractor.
 10. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- G. Compaction of Soil Backfills and Fills
1. Following inspection as specified above, approved backfill material shall be deposited in the trench with hand shovels, not by means of wheelbarrows, carts, trucks, bulldozers, or similar equipment.
 2. Place backfill and fill soil materials in layers not more than 4 inches in loose depth for material compacted by hand-operated tampers until the pipe has a cover of not less than two (2) feet. The remainder of the backfill material shall then be deposited in the trench in eight (8) inch layers and compacted.
 3. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:
 - a. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent of dry weight compaction.
5. Mechanical tampers, for compacting backfill, shall be tampers capable of exerting a blow equal to 250 foot-pounds per square foot (FT2) of area of the tamping face.
6. Work broken or ruptured by improperly placed backfill shall be removed and replaced by the Contractor at no additional cost to the Owner.
7. Any trenches improperly backfilled shall be reopened, then refilled and compacted to the required grade and smoothed off.

H. Field Quality Control

1. Test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
 - a. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet or less of trench length but no fewer than two tests.
2. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.13 EQUIPMENT BASES AND SUPPORTS

- A. Concrete bases, curbs, and supports will be furnished and installed under this Division and shall be in accordance with Division 3.
- B. The Subcontractors shall furnish, to the General Contractor, all required foundation sizes, bolts, washers, sleeves, plates and templates for equipment.
- C. The size of the foundation bolts shall be as recommended by the manufacturer.
- D. All equipment shall be set on the foundations, shimmed level with steel shims, and grouted up under base for uniform bearing by the Subcontractor.
- E. Under this Section, provide all equipment supports; consisting of inertia pads, platforms, gratings, structural members and related materials required for the mechanical and electrical work.
- F. The type and size of the supporting channels and supplementary steel shall be determined by the Subcontractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.14 DEMOLITION

- A. All existing piping, conduit, equipment, ductwork, and materials not required for re-use or re-installation shall be removed. Any existing materials and equipment which are removed and are desired by the Owner or are indicated to remain the property of the Owner, shall be delivered to him on the premises by the Contractor where directed by the Architect. All other materials and equipment which are removed shall become the property of the Contractor and shall be removed by him from the premises.
- B. Existing piping that remains concealed, buried, or otherwise contained in the remaining slabs and walls shall be capped, plugged, or otherwise sealed. All pipes shall be cut so that their capped or plugged ends will be below the finished floors or behind finished surfaces.
- C. Existing wiring, where possible, shall be removed or pulled through conduits. Wiring remaining shall be cut back behind the termination of conduits so that conduits can be adequately capped, plugged, or sealed.

3.15 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. When existing mechanical work is removed, all pipes, valves, ducts, and materials shall be removed to a point below the finished floors or behind finished walls and capped. Such points shall be far enough behind finished surfaces to allow for the installation of the normal thickness of finished material.
- B. When the work specified hereinafter connects to existing equipment, piping, or ductwork, the Contractor shall perform all necessary alterations, cuttings, or fitting of existing work as may be necessary or required to make satisfactory connections between the new and existing work and to leave the completed work in a finished and workmanlike condition, to the entire satisfaction of the Architect.
- C. When the work specified hereinafter or under other divisions of the contract necessitates relocation of existing equipment, piping, or ductwork, the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike condition, to the satisfaction of the Architect. All work resulting in an extra to the contract shall be approved by the Owner and Architect before proceeding.
- D. All cutting and patching necessary for the installation of the mechanical work shall be done under this Division. Any damage done to the work already in place shall be repaired at the Contractor's expense. Patching shall be uniform in appearance and shall match the surrounding surface.
- E. When the work specified hereinafter connects to existing piping, to avoid possible cross-connection of supply and return lines, the Contractor shall field verify the configuration of supply and return lines, using an appropriate temperature sensing or pressure device, before making final connections. Any discrepancy between construction documents and field verification should be promptly reported to the Architect before completing piping installation, so proper piping configuration can be verified.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.16 MOLD AND CONDENSATION PREVENTION DURING CONSTRUCTION

- A. Piping Systems: Cold piping systems shall not be operated prior to insulation and vapor barrier installation in order to prevent condensation on the piping.
- B. Air Systems: Air handling systems shall not be operated prior to insulation and vapor barrier installation in order to prevent condensation on the ductwork. Air systems shall not be operated in portions of the building not yet fully enclosed, where systems can be exposed to warm, humid air conditions.
- C. Room thermostats shall not be set lower than 74 degrees F.
- D. Contractor shall notify the Architect immediately if signs of condensation or mold are discovered.

END OF SECTION 230500

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR MECHANICAL EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, induction motors for use on alternating-current power systems and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

1.4 SUBMITTALS

- A. Shop Drawings and Product Data: Shop drawings and product data for motors shall be provided with the submittal package for the piece of equipment that it serves. In accordance with Division 01, Section "Submittals" provide the following:
 - 1. Product catalog data: nameplate data and ratings; materials of construction; mounting arrangement, size and location of motor terminal box and conduit entry, grounding lugs and coatings.
- B. Warranties
 - 1. In addition to the warranty requirements of the General Conditions, warranties for each motor shall be covered in the warranty for the entire mechanical assembly (fan & motor, pump and motor, etc).
- C. Manufacturer Seismic Qualification Certification: Submit certification that motors, accessories, and components will withstand seismic forces defined in Division 23, Section "Mechanical Vibration, Sound and Seismic Controls." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Operation and Maintenance Data: For factory-installed motors to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain factory-installed motors through one source from a single manufacturer.
- 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. Comply with NFPA 70, "National Electrical Code."
- D. NRTL Listing: Motors shall be NRTL-listed.
 1. Term "Listed": As defined in "National Electrical Code," Article 100.
 2. Listing Agency Qualifications: "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.
- E. Comply with NEMA MG 1, "Motors and Generators."
- F. Comply with UL 1004, "Motors, Electric."
- G. Provide factory test reports in accordance with Part 2 of this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Whenever possible, motor and driven equipment shall be shipped complete as an entire assembly.
- B. Inspect equipment immediately upon arrival and any irregularities or damage shall be reported to the Manufacturer/Supplier immediately.
- C. Store in accordance with manufacturer's recommendations.

1.7 IDENTIFICATION

- A. Nameplates: All motors shall have a stainless steel nameplate attached with stainless steel fasteners on the motor. The nameplate shall be stamped with nameplate markings listed in NEMA MG 1 20.60, plus the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Manufacturer
2. Model Number
3. Serial Number
4. Nominal efficiency
5. Minimum efficiency
6. Temperature Rise
7. Bearing manufacturer's name and catalog number

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Motor requirements apply to factory-installed motors except as follows:
 1. Different ratings, performance, or characteristics for motor are specified in another Section.
 2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
- C. Contractor assumes responsibility for the correct direction of rotation required by the equipment drives. In the event of damage due to reverse rotation, the equipment shall be repaired or replaced at no charge to the Owner.
- D. Motor Bearings: Motor bearings shall be specifically designed for the drive application, and shall be approved by the Engineer. Bearings shall have a minimum bearing life of B-10 or L-10 as defined by the AFBMA. Bearings shall be designed to carry the total hydraulic and static thrust developed by the driven load. Bearings shall be grease or oil lubricated. Oil lubricated motors shall be fitted with gravity-feed oil reservoirs. Grease lubricated bearings shall be regreasable (not sealed) and shall be supplied with grease fittings and drain plugs. Medium voltage and variable frequency controlled motor bearings shall be electrically isolated from the shaft on at least one end to prevent transmission of electric current. Current drain brushes shall be fitted where it is necessary to divert the flow of electrical current from bearings. Bearings, housing and brackets shall be constructed to permit access, removal and replacement of the bearings without disassembly of the motor.
- E. Rotor: The rotor shall be dynamically and statically balanced. Assembled motor shall be tested at the factory in accordance with latest applicable NEMA MG 1 and IEEE 112 methods of testing, and balanced at no more than 0.001 inches total peak-to-peak deflection on the bearing housing and the shaft. Overall vibration readings, including all vibration frequencies, shall be taken and recorded at no load and design speed.
- F. Terminal Box: Motors shall have a watertight cable terminal box. Terminal box shall be oversized, diagonally split, and rotatable in 90o increments to allow conduit and cable entry from top, bottom and sides.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- G. Motor Leads: Motor leads shall be a minimum of 6 inches in length. All motor leads shall be extended from the conduit box. Motors rated over 200 HP or over 600V shall have insulated tin plated copper busbar terminals with bolt holes for compression wire lugs.
- H. Drains and Breathers: Provide drain(s) in the bottom of the motor at the lowest point(s). Enclosed motors shall be fitted with breathers.
- I. Screens: Provide stainless steel screens at motor ventilation openings.
- J. Motor Shaft: The motor shaft shall be ASTM A322 GR140 (AISI 4140) steel and shall be sized to accommodate the required power and torque. Provide shaft end with keyway for connection to coupling with the pump shaft. Coordinate shaft design requirements with driven load.
- K. Stainless Steel Hardware: Provide corrosion resistant hardware for motor components including grease fittings, plugs, nuts, bolts, washers and screws.
- L. Motor Casing and Coating: Housings shall be degreased, primed and painted both inside and outside with a rust inhibitive primer and corrosion resistant polyester paint. Painting shall be performed prior to installing the motor stator windings. The primer and paint materials selected shall be suitable for the environment encountered, both inside and outside of the casing.
- M. Motors connected to Variable Frequency Drives shall be "inverter duty" with additional magnet wire insulation to achieve a minimum motor impulse voltage rating equal to the VFD manufacturer's recommendations for the motor, cable size, and cable length actually installed.
- N. Shaft Grounding Ring: Each motor shaft shall be provided with a Shaft Grounding Ring (SGR) that will provide a reliable low resistance path from the motor shaft to the motor frame to prevent the buildup of destructive high frequency shaft currents that are created by the Pulse Width Modulation of the Variable Frequency Drive units. The SGR shall encircle the shaft and shall be designed to promote efficient discharge of the high frequency shaft currents to the motor frame. The motor frame shall be inherently grounded by design.
- O. Power Factor Correction Capacitors: Provide motor power factor correction capacitors for all motors rated 600V or less (except variable frequency controlled motors) with less than 90% uncorrected power factor. Motor power factor correction capacitors shall be sized as recommended by the motor manufacturer to correct the motor power factor to over 90%. Motor power factor correction capacitor sizes shall not be larger than the maximum size recommended by the motor manufacturer. Enclosure type shall be NEMA 12. Capacitors shall be dry film type with fuses and discharge resistors.
- P. Composite Factor: Each motor, 1 HP or larger, or motor driven equipment, 1 HP or larger shall have a composite power factor (PF) rating of ninety (90) percent to 100 percent when the driven equipment is operating at the design duty defined on the drawings. Power factor correction devices shall be provided to meet the stated criteria.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- Q. Devices such as capacitors, or equipment such as solid state power factor controllers, shall be provided as part of the motor or item of motor driven equipment when required for power factor correction. Devices shall be completely mounted and wired to the motor terminal except as follows:
 - 1. For a motor or motor driven equipment requiring other than across-the-line starting, power factor (PF) correcting capacitors, or other equipment, shall be connected to motor terminals via a contactor (controller) with a 120 volt alternating current (VAC) coil. The 120 volt alternating current (VAC) coil shall be energized via an auxiliary contact on the contactor (controller) used to establish the "run" operating mode for the motor driven equipment.
 - 2. For two (2) speed motors, power factor (PF) shall be corrected at each speed via separate groups of capacitors or other equipment for each speed. Each group of PF correcting components shall be connected to motor terminals via a separate contactor (controller) with a 120 volt alternating current (VAC) coil. Each 120 volt alternating current (VAC) coil shall be energized via an auxiliary contact on the contactor or controller used to establish "run" operations at each speed.
- R. Locked rotor kVA shall not exceed NEMA Code Letter F for motors over 10 horsepower.
- S. Motors shall have the following enclosure types in accordance with NEMA MG 1:
 - 1. For clean dry indoor areas: open drip proof (ODP) fully-guarded
 - 2. For outdoor locations: totally-enclosed fan-cooled for small and medium machines, weather protected type II for large machines
 - 3. Explosion-proof machines shall be provided for hazardous areas classified in accordance with NFPA 70 (National Electrical Code). Explosion proof motors shall be NRTL-listed for the hazardous area classification.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Motors ½ HP and Larger: Three phase, unless otherwise indicated.
- D. Motors Smaller Than ½ HP: Single phase.
- E. Frequency Rating: 60 Hz.
- F. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Stator: Copper windings, unless otherwise indicated.
 - 1. Multispeed Motors: Separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: One temperature rise one class below the insulation rating class; for example, Class B temperature rise with Class F insulation.
- H. Insulation: Class F, unless otherwise indicated.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - 5. Motors operating at higher than 60 Hz must include documentation that the motors and bearings are capable of operation at the proposed speed, without reduction of efficiency, motor life or bearing life. Maximum operating frequency shall be 90 Hz.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONICALLY COMMUNICATED MOTORS

- A. Microprocessor-Based Electronic Control Module: Converts 120 V or 240 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
- B. Three-phase power motor module with permanent magnet rotor.
- C. Digital speed controller/LED display.
- D. Building Automation System Interface: Via Digital Serial Interface (DSI).

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. Check operating motors for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.
- B. Report unusual conditions.
- C. Correct deficiencies.

END OF SECTION 230513

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 230529 - 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 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal hanger-shield inserts.
 - 4. Fastener systems.
 - 5. Pipe stands.
 - 6. Pipe-positioning systems.
 - 7. Equipment supports.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
 - 3. Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts" for duct hangers and supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Pipe stands.
 - 3. Equipment supports.

1.4 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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.
 - 3. Design seismic-restraint hangers and supports for piping and equipment.

2.2 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: Hot-dip galvanized or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
 - 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.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL HANGER-SHIELD INSERTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Pipe Shields Inc or comparable product by one of the following:
 - 1. Carpenter & Paterson, Inc
 - 2. Clement Support Services
 - 3. ERICO International Corporation
 - 4. Insulation Components, Inc.
 - 5. National Pipe Hanger Corporation
 - 6. Pipe Shields Inc.
 - 7. Piping Technology & Products, Inc
 - 8. Rilco Manufacturing Co., Inc

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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.
- C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-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 shall cover entire circumference of pipe. Shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 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.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. MKT Fastening, LLC
 - d. Simpson Strong-Tie Co., Inc.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line, an Eaton business
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - d. MKT Fastening, LLC
 - 2. Indoor Applications: Zinc-coated or stainless steel.
 - 3. Outdoor Applications: Stainless steel.
- C. Per IBC Section 1912 and ACI 318 Appendix D, all concrete anchors within the scope of ACI 318 require approved anchors for crack concrete. Attachment devices shall have certified load test data from an independent test laboratory and shall be capable of carrying a minimum of five times the design load. The concrete anchors for the following supported items need to meet the crack concrete requirements:
 - 1. Any suspended pipe, larger than 2", regardless of material.
 - 2. All components with an I_p 1.5.
 - 3. All components required to function after a seismic event.
 - 4. Anywhere required by ASCE 7.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

5. All suspended HVAC and air distribution equipment, including air handling units, supply air terminal units, fan coil units and fans.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C 1107/C 1107M, 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 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported operating components with a design safety factor of not less than five.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
 - 3. The use of cable ties, zip ties and/or tie wraps for attaching piping to metal trapeze pip-hanger is prohibited. Provide appropriate strut clamps, brackets and/or similar attachments to properly secure piping to trapeze pipe-hangers.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger for insulated piping.
- D. 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.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. 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.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. 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.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 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 2-1/2 and Larger: Include thermal hanger shield inserts of length at least as long as protective shield. Insert thickness shall be the same thickness as piping insulation. Fill interior voids with insulation that matches adjoining insulation and seal as appropriate.
- M. In no case shall wire or perforated strap be used for pipe or conduit support.

3.3 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.

3.4 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.5 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-inch.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications with field-applied finish.
- D. Use hangers and supports with electro-galvanized coatings for piping and equipment that will not have field-applied finish.
- E. Use hot dip galvanized pipe hangers and stainless-steel attachments for exterior applications. Zinc plated hangers and attachments are not acceptable for exterior use.
- 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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 unnecessary.
 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 unnecessary.
 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. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.
- K. 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.
- L. 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.
- M. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.
- N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

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.
- B. The International Building Code and ASCE/SEI 7 Standard apply to all work associated with the seismic installation of all new mechanical piping and equipment. Refer to Structural drawings and ASCE/SEI 7 for seismic and wind loads and additional information.

1.2 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Air-spring isolators.
 - 11. Restrained-air-spring isolators.
 - 12. Elastomeric hangers.
 - 13. Spring hangers.
 - 14. Snubbers.
 - 15. Restraints - rigid type.
 - 16. Restraints - cable type.
 - 17. Restraint accessories.
 - 18. Post-installed concrete anchors.
 - 19. Concrete inserts.
 - 20. Vibration isolation equipment bases.
 - 21. Restrained isolation roof-curb rails.
- B. Related Requirements:
 - 1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
 - 2. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.3 DEFINITIONS

- A. ASCE/SEI: American Society of Civil Engineers/Structural Engineering Institute
- B. IBC: International Building Code.
- C. ICC-ES: ICC-Evaluation Service.
- D. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Include load rating for each wind-force-restraint fitting and assembly.
 - 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic- and wind-force-restraint component.
 - 4. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
 - 5. Annotate to indicate application of each product submitted and compliance with requirements.
 - 6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal:
 - 1. For each seismic-restraint and wind-load protection device, including seismic-restrained mounting, pipe-riser resilient support, snubber, seismic restraint, seismic-restraint accessory, concrete anchor and insert, and restrained isolation roof-curb rail that is required by this Section or is indicated on Drawings, submit the following:
 - a. Seismic and Wind-Load Restraint, and Vibration Isolation Base Selection: Select vibration isolators, seismic and wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
 - b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
 - d. Seismic Design Calculations: Submit all input data and loading calculations prepared under "Seismic Design Calculations" Paragraph in "Performance Requirements" Article.
 - e. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.
 - f. Qualified Professional Engineer: All designated-design submittals for seismic- and wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.
2. Seismic- and Wind-Restraint Detail Drawing:
 - a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.
3. All delegated-design submittals for seismic- and wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
4. Product Listing, Preapproval, and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).
5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer and testing agency.
- B. Welding certificates.
- C. Field quality-control reports.
- D. Seismic Qualification Data: Provide special certification for designated seismic systems as indicated in ASCE/SEI 7 Paragraph 13.2.2, "Special Certification Requirements for Designated Seismic Systems" for all Designated Seismic Systems identified as such on Drawings or in the Specifications.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Provide equipment manufacturer's written certification for each designated active mechanical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7 and AHRI 1270, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction or experience data as permitted by ASCE/SEI 7.
 2. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in ASCE/SEI 7.
 3. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by a licensed professional engineer.
- E. Wind-Force Performance Certification: Provide special certification for HVAC components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-force performance certification.
1. Provide equipment manufacturer's written certification for each designated HVAC device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
 2. Provide manufacturer's written certification for each designated louver, damper, or similar device, stating that it will remain in place and protect opening from penetration of windborne debris and comply with all requirements of authorities having jurisdiction.
 3. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-spring isolators and restrained-air-spring isolators to include in operation and maintenance manuals.
- B. Manufacturer's Inspection Report: Contractor shall submit factory-authorized service representative's final report indicating all restraints and isolation devices as being properly installed or requiring correction.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic- and Wind-Load-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

third-party listing by one or more of the following: an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.

1.8 COORDINATION

- A. Coordinate with vibration isolation restraint manufacturer and the structural contractor/engineer of record to locate and size structural supports underneath vibration isolated restrained equipment (e.g. roof curbs, cooling towers, chillers and other similar equipment).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic and wind- load control system.
 - 1. Seismic and Wind-Load Performance: Equipment shall withstand the effects of earthquake motions and high wind events determined in accordance with ASCE/SEI 7.
- B. Seismic Design Calculations:
 - 1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to is the currently adopted edition.
 - a. Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
 - b. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
- C. Wind-Load Design Calculations:
 - 1. Perform calculations to obtain force information necessary to properly select wind-load-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to is the currently adopted edition.
 - a. Data indicated below that are specific to individual pieces of equipment must be obtained by Contractor and must be included in individual component submittal packages.
 - b. Coordinate design wind-load calculations with seismic load calculations for equipment requiring both seismic and wind-load reinforcement. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Fire/Smoke Resistance: Seismic- and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- E. Component Supports:
 - 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 - 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7.

2.2 GENERAL

- A. Select vibration isolating units for the lowest operating speed of equipment, so designed that natural frequency of equipment and base mass is not less than 1.5 times the lowest operating frequency of the moving equipment, but not a multiple or harmonic of the base frequency. Furnish vibration isolation producing a uniform loading and deflection even when equipment weight is not evenly distributed, vibration isolation shall be stable during starting and stopping of equipment without excessive traverse and eccentric movement of equipment.
- B. The installed vibration isolation system for each floor or ceiling mounted item of equipment shall have a maximum lateral motion under equipment start up and shut down conditions of 1/4 inch. Motions in excess shall be restrained by approved spring type mounting.
- C. The type of isolation, base, and minimum static deflection shall be as required for each specific equipment application, but not less than that specified herein when supported on a solid concrete structural slab having a thickness of not less than four (4) inches.
 - 1. Should vibration isolators installed for the equipment prove inadequate to prevent transmission of equipment vibrations to the building structure or limit equipment vibration originated noise in the building spaces to acceptable levels, the isolators shall be replaced with units having the largest deflection that can be practicably installed.
- D. All springs installed outdoors shall be cadmium-plated, zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
- E. All isolators installed outdoors shall have base plates with bolt holes for fastening the isolators to the support members.

2.3 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. California Dynamics Corporation

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Isolation Technology, Inc
- c. Kinetics Noise Control, Inc.
- d. Mason Industries, Inc.
- e. The VMC Group
- f. Vibration Eliminator Co., Inc.
- g. Vibration Isolation Co., Inc.
- h. Vibration Mountings & Controls/Korfund.
- i. Vibro-Acoustics, Inc.
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

2.4 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. California Dynamics Corporation
 - b. Isolation Technology, Inc
 - c. Kinetics Noise Control, Inc.
 - d. Mason Industries, Inc.
 - e. The VMC Group
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation Co., Inc.
 - h. Vibration Mountings & Controls/Korfund.
 - i. Vibro-Acoustics, Inc.
 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod (where required).
 9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.5 RESTRAINTS - RIGID TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. California Dynamics Corporation
 - 3. Hilti, Inc.
 - 4. Mason Industries, Inc.
 - 5. Unistrut; Part of Atkore International
- B. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.6 RESTRAINTS - CABLE TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Gripple Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Novia; A Division of C&P
 - 5. Vibration & Seismic Technologies, LLC
 - 6. Vibration Mountings & Controls, Inc.
- B. Seismic-Restraint Cables: ASTM A603 galvanized-steel or ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.
- C. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.7 RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
 - 4. Novia; A Division of C&P
 - 5. TOLCO
 - 6. Vibration & Seismic Technologies, LLC
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.8 POST-INSTALLED CONCRETE ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
 - 5. Unistrut; Atkore International.
- B. Mechanical Anchor Bolts:
 - 1. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
- C. Adhesive Anchor Bolts:
 - 1. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
- D. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7, Ch. 13.
 - 1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - 2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

2.9 CONCRETE INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Hilti, Inc.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Mason Industries, Inc.
 4. Simpson Strong-Tie Co., Inc.
 5. Unistrut; Atkore International.
- B. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.
- C. Comply with ANSI/MSS SP-58.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static, wind load, and seismic loads within specified loading limits.

3.3 INSTALLATION OF VIBRATION-CONTROL, WIND-LOAD CONTROL, AND SEISMIC-RESTRAINT DEVICES

- A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
- B. Provide seismic-restraint and wind-load control devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- D. Installation of vibration isolators, wind-load restraints, must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- F. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint, and wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- H. Install seismic- and wind-load-restraint cables so they do not bend across edges of adjacent equipment or building structure.
- I. Equipment Bases:
 - 1. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - b. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - f. Cast-in-place concrete materials and placement requirements are specified in Division 3.
- J. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction that provides required submittals for component.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- K. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- L. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- M. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- N. Mechanical Anchor Bolts:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Provide flexible connections in piping systems where they cross structural seismic joints, expansion joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in other sections for piping flexible connections.

3.5 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT BASES

- A. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate dimensions of steel equipment rails and bases, concrete inertia bases, and restrained isolation roof-curb rails with requirements of isolated equipment specified in this and other Sections. Where dimensions of these bases are indicated on Drawings, dimensions may require adjustment to accommodate actual isolated equipment.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.6 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Perform tests and inspections with the assistance of a factory-authorized service representative.
 - 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 4. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 5. Test no fewer than four of each type and size of installed anchors and fasteners selected by Architect.
 - 6. Test to 90 percent of rated proof load of device.
 - 7. Measure isolator restraint clearance.
 - 8. Measure isolator deflection.
 - 9. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Units will be considered defective if they do not pass tests and inspections.
- E. Prepare testing agency test and inspection reports.
- F. Manufacturer's Inspection:
 - 1. A representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation errors, improperly selected isolation or restraint devices, or other faults that could affect the performance of the system.
 - 2. Contractor shall submit manufacturer's representative's final report indicating all isolation as being properly installed or requiring correction. If corrections are required, include steps to be taken to properly complete the isolation work.

3.8 VIBRATION ISOLATION AND SEISMIC-RESTRAINT SCHEDULE

- A. Suspended Fans:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Isolation Type: Spring Hanger
 2. Base Deflection: 1.5"
- B. Air-Cooled Condensers and Condensing Units (On Grade):
1. Isolation Type: Elastomeric Isolation Pad
 2. Deflection: 0.25"

END OF SECTION 230548

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 230593 - 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 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Testing, Adjusting, and Balancing of Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - c. Multizone systems.
 - 2. Testing, adjusting, and balancing of equipment.
 - 3. Duct leakage tests verification.
 - 4. HVAC-control system verification.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- E. TDH: Total dynamic head.
- F. UFAD: Underfloor air distribution.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. 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.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by AABC or NEBB:
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.7 WARRANTY

- A. Performance Warranty:
 - 1. If AABC standards are used, provide a warranty on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
 - 2. If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents.
- B. Warranty includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, available TAB specialists that may be engaged include, but are not limited to, the following:
 - 1. Carolina Air & Water Balancing Company, Inc.
 - 2. Hall Technology, Inc.
 - 3. KLG Jones, LLC.
 - 4. Palmetto Air & Water Balance, Inc.

3.2 EXAMINATION

- A. 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.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.
- F. 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.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
- K. Examine operating safety interlocks and controls on HVAC equipment.
- L. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- M. 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.

3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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. Windows and doors are installed.
- j. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in ASHRAE 111 or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment casings 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. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230700 "HVAC 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.

3.5 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
 - 1. Motors.
 - 2. Fans and ventilators.
 - 3. Terminal units.
 - 4. Condensers.
 - 5. Dedicated outdoor-air units.
 - 6. Packaged air conditioners.
 - 7. Split-system air conditioners.
 - 8. Variable-refrigerant-flow systems.
 - 9. Heat pumps.
 - 10. Valance heating and cooling units.
 - 11. Coils.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.6 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' Record drawings duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. 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.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.7 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 main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
 - c. Where duct conditions are unsuitable 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:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 4. Obtain approval from Architect 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.
 5. 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 occurs. 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.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
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, speed, 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.

3.8 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Adjust the variable-air-volume systems as follows:
1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
 2. Verify that the system is under static pressure control.
 3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the

- terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
 - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
 5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow, so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
 - d. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 6. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
 7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Balance the return-air ducts and inlets.
 - b. Verify that terminal units are meeting design airflow under system maximum flow.
 8. Re-measure the inlet static pressure at the most critical terminal unit, and adjust the system static pressure set point to the most energy-efficient set point to

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

maintain the optimum system static pressure. Record set point and give to controls Contractor.

9. Verify final system conditions as follows:
 - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.
 - c. Re-measure final fan operating data, speed, volts, amps, and static profile.
 - d. Mark final settings.
 - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
 - f. Verify tracking between supply and return fans.

3.9 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. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.10 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

- A. Verify proper rotation of fan(s).
- B. Measure and record entering- and leaving-air temperatures.
- C. Measure and record entering and leaving refrigerant pressures.
- D. Measure and record operating data of compressor(s), fan(s), and motors.

3.11 DUCT LEAKAGE TESTS

- A. Witness the duct leakage testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified limits.
- C. Report deficiencies observed.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.12 HVAC CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 - 1. Verify HVAC 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.

3.13 TOLERANCES

- A. Set HVAC system's airflow 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. Heating-Water Flow Rate: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.14 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.15 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.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. 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 specialist.
 - 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 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. Heating coil, dry-bulb conditions.
 - e. Face and bypass damper settings at coils.
 - f. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - g. Variable-frequency controller and inlet vane settings for variable-air-volume systems.
 - h. Settings for pressure controller(s).
 - i. Other system operating conditions that affect performance.
 - 16. Test conditions for pump performance forms, including the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Variable-frequency controller settings for variable-flow hydronic systems.
 - b. Settings for pressure controller(s).
 - c. 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, 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 speed.
 - 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 airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan speed.
 - d. Inlet and discharge static pressure in inches wg.
 - e. For each filter bank, 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. List for each internal component with pressure-drop, static-pressure differential in inches wg.
 - j. Outdoor airflow in cfm.
 - k. Return airflow in cfm.
 - l. Outdoor-air damper position.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- m. Return-air 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. Airflow 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. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

- 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and speed.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Center-to-center dimensions of sheave and amount of adjustments in inches.
- 2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btu/h.
 - i. High-fire fuel input in Btu/h.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btu/h.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h.
- 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 speed.
 - 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 speed.
 - 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 fan 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..

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- g. Indicated airflow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual airflow 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. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils of terminal units, include the following:

- 1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
- 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.

L. Instrument Calibration Reports:

- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of the Architect, Owner's representative or Commissioning authority.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Architect, Owner's representative or Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
 - 2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.
- F. Prepare test and inspection reports.

3.17 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 230593

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 230700 - HVAC INSULATION

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 insulation for the following HVAC services:
 - 1. HVAC piping.
 - 2. HVAC equipment.
 - 3. HVAC duct services.

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).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail removable insulation at equipment connections.
 - 7. Detail application of field-applied jackets.
 - 8. Detail application at linkages of control devices.
 - 9. Detail field application for each equipment type.
- C. Samples:
 - 1. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.
- 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 PERFORMANCE REQUIREMENTS

- 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. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

- A. Comply with requirements in PART 3 - EXECUTION 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Airex Manufacturing
 - c. Armacell LLC
 - d. K-Flex USA
 - 2. Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 3. Thermal conductivity (k-value) at 75 deg F shall be 0.25 Btu x in./h x sq. ft. x deg F or less (1-inch wall).
- G. Mineral-Fiber Blanket Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Manson Insulation Inc.
 - e. Owens Corning
 - 2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I without factory-applied jacket, Type II with factory-applied vinyl jacket or Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 3. Compressed thermal conductivity (k-value) at 75 deg F shall be 0.25 Btu x in./h x sq. ft. x deg F or less. Minimum installed R-Value of 3.0 (hr•ft²•°F)/Btu per inch thickness.
- H. Mineral-Fiber Board Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Manson Insulation Inc.
 - e. Thermafiber, Inc.; an Owens Corning company
 - 2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 3. Thermal conductivity (k-value) at 75 deg F shall be 0.23 Btu x in./h x sq. ft. x deg F or less.
- I. Polyisocyanurate:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow
 - b. ITW Insulation Systems; Illinois Tool Works, Inc.
 - c. Johns Manville; a Berkshire Hathaway company
2. Faced, rigid cellular polyisocyanurate sheathing material intended for use as thermal duct insulation.
3. Comply with ASTM C1289 Type 1, Class 1. The compressive resistance shall not be less than 16.0 psi and a minimum installed R-Value of 6.0 (hr•ft²•°F)/Btu per inch thickness.
4. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - a. Duct Applications: FSK.

2.3 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction. Fire barrier duct wrap used for commercial kitchen grease duct systems shall be third party certified to ASTM E2336 and ISO 6944.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M
 - b. CertainTeed Corporation
 - c. Johns Manville; a Berkshire Hathaway company
 - d. Nelson Firestop; a brand of Emerson Industrial Automation
 - e. Thermal Ceramics
 - f. Unifrax Corporation

2.4 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.5 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. For indoor applications, use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aeroflex USA, Inc.
 - 2. Armacell LLC
 - 3. Childers Brand; H. B. Fuller Construction Products
 - 4. Dow Corning Corporation
 - 5. Eagle Bridges - Marathon Industries
 - 6. Foster Brand; H. B. Fuller Construction Products.
 - 7. Johns Manville; a Berkshire Hathaway company
 - 8. K-Flex USA
 - 9. P.I.C. Plastics, Inc.
 - 10. Mon-Eco Industries, Inc.
 - 11. Speedline Corporation
 - 12. Vimasco Corporation.
- D. Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
- E. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- G. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.6 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. For indoor applications, use mastics that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Childers Brand; H. B. Fuller Construction Products
 - 2. Eagle Bridges - Marathon Industries
 - 3. Foster Brand; H. B. Fuller Construction Products.
 - 4. Knauf Insulation
 - 5. Mon-Eco Industries, Inc.
 - 6. Vimasco Corporation
- D. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Color: White.

E. 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.
4. Color: White.

2.7 LAGGING ADHESIVES

A. 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).

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Childers Brand; H. B. Fuller Construction Products
2. Foster Brand; H. B. Fuller Construction Products.
3. Vimasco Corporation

C. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
2. Service Temperature Range: 0 to plus 180 deg F.
3. Color: White.

2.8 SEALANTS

A. Use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Childers Brand; H. B. Fuller Construction Products
2. Eagle Bridges - Marathon Industries
3. Foster Brand; H. B. Fuller Construction Products.
4. Knauf Insulation
5. Mon-Eco Industries, Inc.
6. Pittsburgh Corning Corporation
7. Vimasco Corporation

C. Polyisocyanurate Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. 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.
- E. ASJ 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.

2.9 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Polyguard Products, Inc.
 - 2. Warranty: Minimum 10-year warranty that water will not leak directly through membrane as a result of deterioration of the membrane caused by ordinary wear and tear.

2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 1. Width: 2 inches.
 2. Thickness: 3.7 mils.
 3. Adhesion: 58 ounces force/inch in width.
 4. Elongation: 8.5 percent.
 5. Tensile Strength: 23 lbf/inch in width.

2.12 SECUREMENTS

- A. Bands:
 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- 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.
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, 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.
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 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. Self-Sticking-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.
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 - 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum 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.
 - 7. 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: 0.062-inch soft-annealed, stainless steel.

2.13 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 or Type 316.

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 and equipment 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
 - 1. For exterior, above-grade piping: Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - a. 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.
 - b. 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.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. 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 equipment, duct and 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 clean and 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.

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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. 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.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. 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 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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, 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. Insulate reheat coils, including exposed tubing U-bends, on concealed air terminal units.
- E. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.

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.
- E. Insulation Installation for Tanks and Vessels:
 1. Install insulation over entire surface of tanks and vessels.
 2. Apply 50 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 3. Seal longitudinal seams and end joints.
- F. Insulation Installation on Pumps:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Fabricate metal boxes lined with elastomeric insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

G. Insulation Installation on HVAC Ducts

1. Install insulation over entire surface of ducts.
2. Apply 50 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
3. 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.

H. Provide latex-based, UV resistant protective coating for outdoor applications.

3.7 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.
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, 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 overcompress 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

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.

3.8 INSTALLATION OF POLYISOCYANURATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.

C. Insulation Installation on Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of polyisocyanurate insulation to valve body.
2. 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.

E. Insulation Installation on Ducts and Plenums:

1. Install insulation over entire surface of ducts.
2. Apply minimum 50 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
3. 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.10 FIELD QUALITY CONTROL

- A. If workmanship is of questionable quality, the contractor shall perform tests and inspections as directed by the Architect.
- B. Tests and Inspections:
 - 1. Inspect field insulated equipment, ductwork, pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 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. HVAC Equipment Items Not Insulated: Unless otherwise indicated, do not install insulation on equipment that is factory insulated.
- C. HVAC Ducts Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch thick.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.
- C. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.
- D. For piping smaller than 1 1/2 inches and located in partitions within conditioned spaces, reduction of the scheduled thickness by 1 inch shall be permitted, but not to a thickness less than 1 inch.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 2 inches thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 2 inches thick.

3.14 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, supply-air and outdoor-air duct insulation shall be the following:
 - 1. Above Ceiling: Mineral-Fiber Blanket: 2 inches thick and 1-lb/cu. ft. nominal density.
 - 2. Within Shafts: Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.
- B. Concealed, return-air duct insulation shall be the following (shafts only):
 - 1. Mineral-Fiber Board: 1 inch thick and 6-lb/cu. ft. nominal density.
- C. Concealed, exhaust-air heat recovery duct insulation shall be the following:
 - 1. Above Ceiling: Mineral-Fiber Blanket: 1 inch thick and 1-lb/cu. ft. nominal density.
 - 2. Within Shafts: Mineral-Fiber Board: 1 inch thick and 6-lb/cu. ft. nominal density.
- D. Concealed, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:
 - 1. Mineral-Fiber Blanket: 2 inches thick and 1-lb/cu. ft. nominal density.
- E. Concealed, supply-air, outdoor-air and exhaust-air plenum insulation shall be the following:
 - 1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.
- F. Concealed, supply-air devices shall be the following:
 - 1. Mineral-Fiber Blanket: 1 inch thick and 1-lb/cu. ft. nominal density.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.15 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Exposed, supply-air and outdoor-air duct insulation shall be the following:
 - 1. Polyisocyanurate Sheathing: 2 inches.
- C. Exposed, return-air duct insulation shall be the following:
 - 1. Polyisocyanurate Sheathing: 2 inches.
- D. Exposed, supply-air and outdoor-air plenum insulation shall be the following:
 - 1. Polyisocyanurate Sheathing: 2 inches.
- E. Exposed, return-air plenum insulation shall be the following:
 - 1. Polyisocyanurate Sheathing: 2 inches.

3.16 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. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Self-Adhesive Outdoor Jacket: 60-mil- thick.
- C. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Self-Adhesive Outdoor Jacket: 60-mil- thick.

END OF SECTION 230700

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 230900 - BUILDING AUTOMATION AND TEMPERATURE CONTROL SYSTEM

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 fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified:

1.3 COMMISSIONING

- A. All building energy-related systems shall be commissioned in order to verify and ensure that fundamental building elements and systems are installed, constructed, calibrated to operate, and perform according to the Owner's Project Requirements, Basis of Design, and Construction Documents.
- B. Refer to Divisions 1 and 23 commissioning specifications for additional information.

1.4 SCOPE

- A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified.
- B. The BAS shall be a Web based system communicating over the building owners Local Area Network (LAN). Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BAS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN. TCP/IP connections and addresses shall be provided by the owner for connection of supervisory panels to the [Agency] network.
- C. The primary desktop and laptop interface will be via a standard Web Browser such as Internet Explorer or Chrome. BAS contractor shall provide software license(s) for BAS WEB access for a minimum of twenty concurrent users.
- D. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

the name of the manufacturer. The installing manufacturer shall certify in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer has supervised their installation. In addition, the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.

- E. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
- F. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes.
- G. Air handling unit control/end devices shall be furnished by the BAS manufacturer and factory installed by the air handling unit manufacturer. Controls contractor shall provide data sheets on all components to be mounted, indicating component dimensions, mounting hardware, and methods, as well as wiring and piping diagrams for each application identified by unit tag per the schedule in the drawings.
- H. Air Handling Unit (AHU) control/end devices shall be furnished by the BAS manufacturer and field installed by the BAS Controls Contractor.
 - 1. AHU smoke isolation dampers and control dampers shall be provided by the AHU manufacturer.
 - a. To maintain the ETL smoke rating, the AHU manufacturer shall also provide the actuators for the smoke isolation dampers.
 - b. All other AHU control damper actuators shall be furnished BAS manufacturer and field installed by the BAS Controls Contractor.
- I. Variable Frequency Drives (VFDs):
 - 1. All pump VFDs, and VFDs for fans not in air handling units, shall be furnished and installed (set in place) by the BAS provider.
 - 2. Air handling unit VFDs shall be furnished and installed by the air handling unit manufacturer.
 - 3. Power wiring for VFDs shall be provided under Division 26.
 - 4. Refer to Section 230550 "Variable Frequency Drives".
- J. The energy profile for the [name of building] shall be added to the existing [name of monitoring system] server software for campus wide monitoring of the following:
 - 1. Week to week energy consumption comparison for building:
 - a. Electricity
 - b. Heating
 - c. Cooling
 - 2. Weekly CO2 production
- K. Lighting Panel BAS Scope of Work
 - 1. BAS Controls Contractor shall provide all necessary materials and labor, including integration devices, to integrate with the lighting panels (LP) as shown on the electrical drawings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- L. BAS provider shall provide IT cabling and network between devices, controllers and building controllers so that a complete BAS is installed, functional and accessible via tie into the BAS network from a single location during TAB and commissioning. BAS network and cabling shall be compliant with and compatible with the Owner's IT department requirements so that BAS may be connected to an Owner's switch(s) once that system is complete.

1.5 INTERFACE REQUIREMENTS

- A. The new system shall be an extension of and connected to the existing [insert existing system] management system which is used for energy management.
- B. The BAS contractor shall provide all necessary hardware and software to integrate the new control system with the existing [insert existing system] BAS without additional hardware or gateways. Integration means the ability to monitor, override, change set points, and provide real-time bi-directional dynamic data exchange between the new control system and the existing BAS hardware and software.
- C. The existing BAS is a [insert existing system] system. The BAS is comprised of multiple supervisory controllers, monitoring and communicating with various building control systems over the Ethernet LAN system. The new building control system will be connected to, and communicate with, the existing campus BAS server via the Ethernet LAN
- D. All new control points, monitoring points and software points shall be added to the existing [insert existing system] BAS database and shall be available for monitoring and adjustment at any computer, with current copy of Microsoft Internet Explorer software (Release 6.0 or later), that is connected to the [Agency] LAN.
- E. All new building software and databases shall be archived on the hard drive at the BAS server. In the event that any building controller should lose its program that controller's archived software program shall be downloaded across the BAS network from the BAS server to the respective building controller.
- F. The BAS contractor will provide all necessary hardware, software, and labor to allow communication with all any computer, with current copy of Microsoft Internet Explorer (Release 6.0 or later), that is connected to the LAN.
- G. Integrity of the existing BAS shall be maintained during installation.
- H. The new building control system shall be compatible in every respect with existing [insert existing system] BAS hardware and software. All new controllers shall be compatible with [insert existing system] database and software development tools.

1.6 WORK BY OTHERS

- A. Electrical Contractor provides:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. 120V power to all BAS and/or Temperature control panels. Where not shown on plans, locations shall be determined by the BAS contractor and coordinated with the Architect and electrical contractor.
 2. Wiring of all power feeds through all disconnect starters to electrical motor.
 3. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by BAS manufacturer.
 4. Wiring of electrical sub-metering devices furnished by BAS manufacturer.
- B. Control Devices for Installation by Installers
1. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.
 2. Deliver the following to duct fabricator and installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.
 - a. Airflow sensors, switches and stations
 - b. Pressure sensors.
 3. Deliver the following to plumbing and HVAC piping installers for installation in piping. Include installation instructions to Installer and supervise installation for compliance with requirements.
 - a. DDC control valves
 - b. Pipe-mounted flow meters
 - c. Pipe-mounted sensors, switches and transmitters.
 - d. Tank-mounted sensors, switches and transmitters.
 - e. Pipe- and tank-mounted thermowells.
 4. Deliver the following to electrical installers for installation. Include installation instructions to Installer and supervise installation for compliance with requirements.
 - a. Meters/Sub-Metering Devices
- C. Communication Interface to Equipment with Integral Controls
1. DDC system shall have communication interface with equipment having integral controls and having a communication interface for remote monitoring or control.
 2. Equipment to Be Connected:
 - a. Acid neutralization system
 - b. Air-cooled chillers
 - c. Air-terminal units
 - d. Boiler controllers
 - e. Commercial Kitchen Hoods (alarm contacts only)
 - f. Computer-room air-conditioning units
 - g. Cooling Towers
 - h. Domestic water booster pumps.
 - i. Dust Collector
 - j. Emergency engine generators
 - k. Fan array controllers
 - l. Fan coil units
 - m. Kitchen coolers and freezers (alarm contacts only)
 - n. Motor control centers
 - o. Packaged air handling unit controllers
 - p. Refrigerant monitoring
 - q. Split-system air-conditioners

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- r. Sump pump unit controllers
 - s. Unit ventilators
 - t. Variable-frequency controllers
 - u. Water-cooled chiller controllers
 - D. Communication Interface to Other Building Systems:
 - 1. DDC system shall have a communication interface with systems having a communication interface.
 - 2. Systems to Be Connected:
 - a. Access controls.
 - b. Elevators.
 - c. Fire-alarm system
 - d. Lighting controls. BAS shall connect to all Lighting Control panels and contactors for lighting control. Refer to the electrical drawings for location and quantity.
 - e. Power monitoring.
 - E. Test, Adjust and Balance:
 - 1. The BAS contractor shall cooperate with the air and water testing, adjusting and balancing (TAB) contractor in the performance of their work as required or directed, including calibration of all sensors and devices.
 - 2. The BAS contractor shall work with the air and water testing, adjusting and balancing (TAB) contractor and commissioning agent (CxA) to utilize the TAB certified measuring instruments to verify BAS temperature and humidity readings as applicable and provide any adjustments in the BAS programming to modify the reading of the BAS sensor to match the TAB reading.
 - F. Commissioning
 - 1. BAS contractor shall work with the Commissioning Agent in the performance of their work as required or directed.
 - 2. Each system upon completion shall be tested in the presence of the Commissioning Agent and shall be shown to be in satisfactory condition.
 - 3. During this test period, the BAS Contractor shall make all necessary adjustments.
 - 4. General operating tests shall cover such time as is necessary to demonstrate that the entire equipment is functioning in accordance with specifications.
 - 5. BAS Contractor shall furnish all instruments, test equipment and personnel that are required for tests.
 - 6. It will be the BAS Contractor's responsibility to schedule the above tests with the Architect and Commissioning Agent.
 - 7. Refer to PART 3 – EXECUTION for additional requirements.
- 1.7 PREINSTALLATION MEETINGS
- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Conduct a pre-installation walk through at the Project site with owner, architect and engineer prior to BAS rough-in to coordinate and confirm all device locations.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.8 ACTION SUBMITTALS

- A. Product Data: For each type of product include the following:
1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
 3. Product description with complete technical data, performance curves, and product specification sheets.
 4. Installation, operation and maintenance instructions including factors effecting performance.
 5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
 - a. Gateways.
 - b. Routers.
 - c. DDC controllers.
 - d. Enclosures.
 - e. Electrical power devices.
 - f. UPS units.
 - g. Accessories.
 - h. Instruments.
 - i. Control damper actuators.
 - j. Control valves and actuators.
 6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
 7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.
- B. Shop Drawings:
1. General Requirements:
 - a. Include cover drawing with Project name, location, Owner, Architect, Contractor and issue date with each Shop Drawings submission.
 - b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
 - c. Drawings Size: 11x17.
 2. Include plans, elevations, sections, and mounting details where applicable.
 3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 4. Detail means of vibration isolation and show attachments to rotating equipment.
 5. Plan Drawings indicating the following:
 - a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork and piping.
 - b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
 - c. Each desktop workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
- e. Network communication cable and raceway routing.
- f. Information, drawn to scale, of $\frac{1}{4}"=1'-0"$.
- g. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.
6. Schematic drawings for each controlled HVAC system indicating the following:
 - a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
 - b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
 - c. A graphic showing location of control I/O in proper relationship to HVAC system.
 - d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
 - e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
 - f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
 - g. Narrative sequence of operation.
 - h. Graphic sequence of operation, showing all inputs and output logical blocks.
7. Control panel drawings indicating the following:
 - a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
 - b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates and allocated spare space.
 - c. Front, rear, and side elevations and nameplate legend.
 - d. Unique drawing for each panel.
8. DDC system network riser diagram indicating the following:
 - a. Each device connected to network with unique identification for each.
 - b. Interconnection of each different network in DDC system.
 - c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.
 - d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.
9. DDC system electrical power riser diagram indicating the following:
 - a. Each product requiring power with associated requirements (volts/phase/hertz/amperes/connection type) listed for each.
10. Monitoring and control signal diagrams indicating the following:
 - a. Control signal cable and wiring between controllers and I/O.
 - b. Point-to-point schematic wiring diagrams for each product.
 - c. Control signal tubing to sensors, switches and transmitters.
 - d. Process signal tubing to sensors, switches and transmitters.
11. Color graphics indicating the following:
 - a. Itemized list of color graphic displays to be provided for each system.
 - b. For each display screen to be provided, a true color copy showing layout of pictures, graphics and data displayed.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. All visible points to be displayed.
 - d. Intended operator access between related hierarchical display screens.
- C. System Description:
 - 1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
 - 2. Complete listing and description of each report, log and trend for format and timing and events which initiate generation.
 - 3. System and product operation under each potential failure condition including, but not limited to, the following:
 - a. Loss of power.
 - b. Loss of network communication signal.
 - c. Loss of controller signals to inputs and outpoints.
 - d. Operator workstation failure.
 - e. Server failure.
 - f. Gateway failure.
 - g. Network failure
 - h. Controller failure.
 - i. Instrument failure.
 - j. Control damper and valve actuator failure.
 - 4. Complete bibliography of documentation and media to be delivered to Owner.
 - 5. Description of testing plans and procedures.
 - 6. Description of Owner training.

1.9 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
 - b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
 - c. As-built versions of submittal Product Data.
 - d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
 - e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
 - f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - g. Engineering, installation, and maintenance manuals that explain how to:
 - 1) Design and install new points, panels, and other hardware.
 - 2) Perform preventive maintenance and calibration.
 - 3) Debug hardware problems.
 - 4) Repair or replace hardware.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
- i. Backup copy of graphic files, programs, and database on electronic media such as digital media.
- j. List of recommended spare parts with part numbers and suppliers.
- k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
- l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
- m. Licenses, guarantees, and warranty documents.
- n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
- o. Owner training materials.

1.10 QUALITY ASSURANCE

- A. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within 20 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.
- B. The manufacturer shall provide onsite, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the BAS.
- C. The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of BAS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of BAS systems similar in size and complexity to this project.
- D. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- E. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology and extend new field panels on a previously installed network.
- F. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths shall comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
 - 2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
 - a. Install updates only after receiving Owner's written authorization.
 - 3. Warranty service shall occur during normal business hours and commence within 24 hours of Owner's warranty service request.
 - 4. Warranty Period: From date of Substantial Completion.
 - a. One-year parts and labor.
 - b. Three-year parts.
 - c. For Gateway: One-year parts and labor warranty for each.
- B. The on-line support services shall allow the local BAS subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

1.12 IDENTIFICATION

- A. Identify control wires with a distinctive number on a nonconducting tag attached to each end or at junction points or by color coding of that wire or tube. Designate on control diagram the identifying color and/or number or other identifying designation used.
- B. Identify all control equipment and devices, including panels, controllers, valves, and automatic dampers, firestats, etc., by a method approved by the Architect. Designations shall match those used on control diagrams and shop drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Automated Logic Corporation
 - 2. Hoffman Building Technologies
 - 3. Johnson Controls Inc. (Metasys).
 - 4. Siemens Building Technologies, Inc.
 - 5. Trane
- B. Basis-of-Design Product: Subject to compliance with requirements, provide a building automation and temperature control system by [insert sole source manufacturer].

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. System must extend and connect to the existing [insert manufacturer] network control systems installed in [insert campus/district].

2.2 GENERAL DESCRIPTION

- A. The Building Automation System (BAS) shall use an open architecture. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- B. The Building Automation shall consist of the following:
 - 1. Standalone Network Control Engine (NCE)
 - 2. Field Equipment Controller(s)
 - 3. Input/Output Module(s)
 - 4. Local Display Device(s)
 - 5. Distributed User Interface(s)
 - 6. Network processing, data storage and communications equipment
 - 7. Other components required for a complete and working BAS
- C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2.3 PERFORMANCE REQUIREMENTS

- A. Delivery of Selected Control Devices: Deliver to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.
- B. Delegated Design, Qualified Professional: Engage a qualified professional to design BAS system to satisfy requirements indicated.
 - 1. System Performance Objectives:
 - a. BAS system manages HVAC systems.
 - b. BAS system operates HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
 - c. BAS system responds to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
 - d. BAS system operates while unattended by an operator and through operator interaction.
 - e. BAS system records trends and transactions of events and produces report information such as performance, energy, occupancies, and equipment operation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths complying with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- D. BAS System Speed:
 - 1. Response Time of Connected I/O:
 - a. Update AI point values connected to BAS system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
 - b. Update BI point values connected to BAS system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
 - c. AO points connected to BAS system to begin to respond to controller output commands within two second(s). Global commands to also comply with this requirement.
 - d. BO point values connected to BAS system to respond to controller output commands within two second(s). Global commands to also comply with this requirement.
 - 2. Display of Connected I/O:
 - a. Update and display analog point COV connected to BAS system at least every 10 seconds for use by operator.
 - b. Update and display binary point COV connected to BAS system at least every 10 seconds for use by operator.
 - c. Update and display alarms of analog and digital points connected to DDC system within 45 seconds of activation or change of state.
 - d. Update graphic display refresh within eight seconds.
 - e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations to not exceed graphic refresh rate indicated.
- E. Network Bandwidth: Design each network of BAS system to include spare bandwidth with BAS system operating under normal and heavy load conditions indicated. Calculate bandwidth usage, and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions. Minimum spare bandwidth as follows:
 - 1. Level 1 Networks: 20.
 - 2. Level 2 Networks: 20
 - 3. Level 3 Networks: 10.
- F. BAS Data Access:
 - 1. When logged into the system, operator able to also interact with any BAS controllers connected to BAS system as required for functional operation of BAS system.
 - 2. Use for application configuration; for archiving, reporting, and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
- G. Future Expandability:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. BAS system size shall be expandable to an ultimate capacity of at least 1.25 times total I/O points indicated.
 2. Design and install system networks to achieve ultimate capacity with only addition of BAS controllers, I/O, and associated wiring and cable. Design and install initial network infrastructure to support ultimate capacity without having to remove and replace portions of network installation.
 3. Operator interfaces installed initially do not require hardware and software additions and revisions for system when operating at ultimate capacity.
- H. Input Point Values Displayed Accuracy: Meet following end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.
1. Energy:
 - a. Thermal: Within 5 percent of reading.
 - b. Electric Power: Within 5 percent of reading.
 - c. Requirements indicated on Drawings for meters not supplied by utility.
 2. Flow:
 - a. Air: Within 2 percent of design flow rate.
 - b. Air (Terminal Units): Within 10 percent of design flow rate.
 - c. Natural Gas: Within 5 percent of design flow rate.
 - d. Water: Within 2 percent of design flow rate.
 3. Gas:
 - a. Carbon Dioxide: Within 50 ppm.
 4. Moisture (Relative Humidity):
 - a. Air: Within 5 percent RH.
 - b. Space: Within 5 percent RH.
 - c. Outdoor: Within 5 percent RH.
 - d. Level: Within 2 percent of reading.
 5. Pressure:
 - a. Air, Ducts and Equipment: 1 percent of instrument range.
 - b. Space: Within 1 percent of instrument range.
 - c. Water: Within 1 percent of instrument range.
 6. Speed: Within 5 percent of reading.
 7. Temperature, Dew Point:
 - a. Air: Within 1 deg F.
 - b. Space: Within 1 deg F.
 - c. Outdoor: Within 3 deg F
 8. Temperature, Dry Bulb:
 - a. Air: Within 1 deg F.
 - b. Space: Within 1 deg F.
 - c. Outdoor: Within 1 deg F.
 - d. Chilled Water: Within 1 deg F.
 - e. Heating Hot Water: Within 1 deg F.
 - f. Temperature Difference: Within 0.25 deg F
 9. Temperature, Wet Bulb:
 - a. Air: Within 1 deg F.
 - b. Space: Within 1 deg F.
 - c. Outdoor: Within 1 deg F.
- I. Precision of I/O Reported Values: Values reported in database and displayed to have following precision:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Current:
 - a. Milliamperes: Nearest 1/100th of a milliampere.
 - b. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.
2. Energy:
 - a. Electric Power:
 - 1) Rate (Watts): Nearest 1/10th of a watt through 1000 W.
 - 2) Rate (Kilowatts): Nearest 1/10th of a kilowatt through 1000 kW; nearest kilowatt above 1000 kW.
 - 3) Usage (Kilowatt-Hours): Nearest kilowatt through 10,000 kW; nearest 10 kW between 10,000 and 100,000 kW; nearest 100 kW for above 100,000 kW.
 - b. Natural Gas (Usage): Nearest 1/10th of a unit (cubic feet, MCF, therm) up to 100 units; nearest unit for above 100 units.
 - c. Thermal, Rate:
 - 1) Heating: For British thermal units per hour, nearest British thermal unit per hour up to 1000 Btu/h; nearest 10 Btu/h between 1000 and 10,000 Btu/h; nearest 100 Btu/h for above 10,000 Btu/h. For MBh, round to nearest MBh up to 1000 MBh; nearest 10 MBh between 1000 and 10,000 MBh; nearest 100 MBh above 10,000 MBh.
 - 2) Cooling: For tons, nearest ton up to 1000 tons; nearest 10 tons between 1000 and 10,000 tons; nearest 100 tons above 10,000 tons.
 - d. Thermal, Usage:
 - 1) Heating: For British thermal unit, nearest British thermal unit up to 1000 Btu; nearest 10 Btu between 1000 and 10,000 Btu; nearest 100 Btu for above 10,000 Btu. For MBtu, round to nearest MBtu up to 1000 MBtu; nearest 10 MBtu between 1000 and 10,000 MBtu; nearest 100 MBtu above 10,000 MBtu.
 - 2) Cooling: For ton-hours, nearest ton-hours up to 1000 ton-hours; nearest 10 ton-hours between 1000 and 10,000 ton-hours; nearest 100 tons above 10,000 tons.
3. Flow:
 - a. Air: Nearest 1/10th of a cubic feet per minute through 100 cfm; nearest cubic feet per minute between 100 and 1000 cfm; nearest 10 cfm between 1000 and 10,000 cfm; nearest 100 cfm above 10,000 cfm.
 - b. Fuel Oil: Nearest 1/10th of a gallon per minute through 100 gpm; nearest gallon per minute between 100 and 1000 gpm.
 - c. Natural Gas: Nearest 1/10th of a cubic feet per hour through 100 cfh; nearest cubic feet per hour between 100 and 1000 cfh; nearest 10 cfh between 1000 and 10,000 cfh; nearest 100 cfh above 10,000 cfh.
 - d. Water: Nearest 1/10th of a gallon per minute through 100 gpm; nearest gallon per minute between 100 and 1000 gpm; nearest 10 gpm between 1000 and 10,000 gpm; nearest 100 gpm above 10,000 gpm.
4. Gas:
 - a. Carbon Dioxide (ppm): Nearest ppm.
5. Moisture (Relative Humidity):
 - a. Relative Humidity (Percentage): Nearest 1 percent.
6. Level: Nearest 1/100th of an inch through 10 inches; nearest 1/10 of an inch between 10 and 100 inches; nearest inch above 100 inches.
7. Speed:
 - a. Rotation (rpm): Nearest 1 rpm.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Velocity: Nearest 1/10th of feet per minute through 100 fpm; nearest feet per minute between 100 and 1000 fpm; nearest 10 fpm above 1000 fpm.
 8. Position, Dampers and Valves (Percentage Open): Nearest 1 percent.
 9. Pressure:
 - a. Air, Ducts and Equipment: Nearest 1/10th of an inch water closet.
 - b. Space: Nearest 1/100th of an inch water closet.
 - c. Water: Nearest 1/10 of a pound per square inch gauge through 100 psig; nearest pound per square inch gauge above 100 psig.
 10. Temperature:
 - a. Air, Ducts and Equipment: Nearest 1/10th of a degree.
 - b. Outdoor: Nearest degree.
 - c. Space: Nearest 1/10th of a degree.
 - d. Chilled Water: Nearest 1/10th of a degree.
 - e. Heating Hot Water: Nearest degree.
 11. Vibration: Nearest 1/10th of an inch per second.
 12. Voltage: Nearest 1/10 V up to 100 V; nearest volt above 100 V.
- J. Environmental Conditions for Controllers, Gateways, and Routers:
 1. Products shall operate without performance degradation under ambient environmental temperature, pressure, and humidity conditions encountered for installed location.
 - a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure to be internally insulated, electrically heated, cooled, and ventilated as required by product and application.
 2. Protect products with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House products not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location dictates the following NEMA 250 enclosure requirements:
- K. Environmental Conditions for Instruments and Actuators:
 1. Instruments and actuators to operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
 2. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled, and/or ventilated as required by instrument and application.
- L. Electric Power Quality:
 1. Power-Line Surges:
 - a. Protect susceptible BAS system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.1 and IEEE C62.41.2.
 - b. Do not use fuses for surge protection.
 - c. Test protection in the normal mode and in the common mode, using the following two waveforms:
 - 1) 10-by-1000-microsecond waveform with a peak voltage of 1500 V and a peak current of 60 A.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 2) 8-by-20-microsecond waveform with a peak voltage of 1000 V and a peak current of 500 A.
2. Ground Fault: Protect products from ground fault by providing suitable grounding. Products to not fail due to ground fault condition.
- M. Backup Power Source:
 1. Serve BAS system products that control HVAC systems and equipment served by a backup power source also from a backup power source.
- N. UPS:
 1. BAS system products powered by UPS units are to include the following:
 - a. Servers.
 - b. Gateways.
 - c. DDC controllers.
 - d. Desktop workstations.
- O. Continuity of Operation after Electric Power Interruption:
 1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems are to automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.4 BAS ARCHITECTURE

- A. Automation Network
 1. The BAS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Utilize existing application and data server as required for systems operation.
 2. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
 3. Network Control Engine (NCE) shall reside on the automation network.
 4. The automation network will be compatible with other campus-wide networks. Where indicated, the automation network shall be connected to the campus network and share resources with it by way of standard networking devices and practices.
- B. Control Network
 1. Network Control Engine (NCE) shall provide supervisory control over the control network.
 2. Control networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 38,400 baud.
 3. DDC Controllers shall reside on the control network
 4. Wireless communication between DDC controllers is acceptable. All sensors shall be wired.
- C. Dedicated Web Based User Interface

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. The BAS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. Real-time control functions, including scheduling, history collection and alarming, shall be resident in the BAS Network Engines and Data Server to facilitate greater fault tolerance and reliability.
2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BAS Contractor and by other third-party applications suppliers, including but not limited to Microsoft Office Applications. Specifically, it must be implemented to conform to the following interface standards.
 - a. Edge or Google Chrome or Safari for user interface functions.
 - b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences and other necessary building management functions.
 - c. Microsoft Outlook or other e-mail programs for supplemental alarm functionality and communication of system events, and reports.
 - d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.
3. PC Hardware/Software – The personal computer(s) shall be configured as specified in the Computing Hardware and Software section.
4. Provide one operational device as herein specified and located on plans.
5. Mobile, Web Based, User Interface (MUI) General
 - a. All functionality as outlined within this section shall be provided as a standard catalog product software suite from the BAS manufacturer. Custom functionality development to meet these requirements is not acceptable.
 - b. The mobile, web-based, user interface shall be HTML5-compliant and provide access to the system from smartphones, tablets, portable and desktop computers. User Interfaces that require software installation on the client device (e.g. Java, Microsoft Silverlight®, Adobe® Flash®), or software downloads from an online app store shall not be acceptable for these purposes.
 - c. The mobile user interface shall provide system operators with a simple space/zone/location-based navigation approach to finding information, including the ability to search for any location by name and to bookmark a location in a standard browser.
 - d. The mobile user interface shall organize and display information using customer specific locations and spaces. At a minimum, the user interface shall provide:
 - 1) Organization of all space, equipment and point information in a familiar way (using standard equipment names and location descriptions), reducing the need for extensive training prior to use.
 - 2) A navigation mechanism or tree for users to select the specific location or space for accessing information – only spaces and locations in the navigation tree or equipment serving that space, nothing more.
 - 3) The ability to search for and/or bookmark any location, space, or equipment by name for quick access to critical or troublesome areas.
 - 4) Application of the same navigation mechanisms across any client device (e.g. Smart phone, tablet, personal computer) for consistency and ease of use.

- e. The same user interface elements shall be accessible from any type of personal computer or mobile device running any type of operating system supported (e.g. iOS, Android, Windows®). It shall automatically adapt and optimize the display for the screen size and touch screen navigation.
- f. Navigation Trees
 - 1) A dedicated location-based navigation tree shall be provided as part of the user interface in order to navigate to specific places within the facility on a hierarchical basis (typ. Campus, Facility, Building, Wing, Floor, Room.)
 - 2) The location-based tree shall use place names familiar to the operator without training or familiarization regarding special codes and conventions utilized in the generation of the BAS.
 - 3) Clicking or tapping on a location name in the tree shall display the home page associated with the space and simultaneously expand the tree to display the next level of spaces below the one selected.
 - 4) Provide a means for qualified users to view an all hardware items navigation tree of devices connected to the BAS network in order to enable troubleshooting of equipment and communications.
 - 5) A click or tap on a device in the network tree shall display a dashboard for that device including information regarding related equipment and access to a separate focus view of commandable points associated with the piece of hardware. A click or tap on such a point shall display a control dialogue box allowing the user to modify or command that point as indicated. The dialog box shall contain an annotation box for describing why the action was taken or special circumstances that apply.
 - 6) Specific hardware and software types in the Network tree shall also include access to one or more the following views in their dashboard depending on hardware type or network element (e.g. MS/TP trunk):
 - a) Summary View
 - b) Diagnostic View
 - c) Network View
 - d) Trend View
 - 7) Provide a means to hide the Network Tree and return to the Spaces Tree at any time by clicking on the Spaces Icon above the tree.
 - 8) Provide a means to restrict user access to any space in the Spaces Tree and thereby prevent manipulation of equipment associated with the space.
- g. Dashboard Displays
 - 1) The user interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.
 - 2) Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:
 - a) Equipment Serving Space
 - b) Potential Problem Areas
 - c) Equipment Summary
 - d) Graphic Display (if specified)
 - e) Schedule

- 3) Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:
 - a) Trend
 - b) Equipment Activity Summary
 - c) Equipment Relationships Summary
 - d) Equipment Data
 - e) Graphic Display
 - f) Schedule
- 4) Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.
- 5) Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.
- 6) Default dashboard displays by space and equipment type shall be created per the guidelines in this specification or by mutual agreement with the Owner's representative.
- h. Alarm Management
 - 1) The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
 - 2) The user interface shall provide notification of new alarms, visually and audibly.
 - 3) The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.
 - 4) The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.
 - 5) The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.
 - 6) The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.
 - 7) The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.
 - 8) The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enable or disable the 24/7 alarm monitor mode if desired.
 - 9) The user interface shall provide the capability to annotate alarms using a pre-defined selection list or by providing custom text.
 - 10) The user interface shall provide the capability to filter down alarm list and bookmark the filtered list, allowing automatic filtering to be applied when the bookmark is accessed.

- 11) Provide a means to export a .csv or .pdf copy of the currently displayed alarm list.
- 12) Provide a means to set up an alarm escalation feature. If an alarm is not acknowledged or discarded by recipients within a user-selected time, the alarm shall be escalated to an additional set of recipients.
- i. Send Announcement
 - 1) Administrative users should have the ability to alert staff of planned outages in advance. The communication avenues should include:
 - a) Email
 - b) A message shown on the login screen
 - c) A banner shown to logged in users
- j. Equipment Activity Summary
 - 1) The user interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.
 - 2) Items shall be listed in timed order with the latest activity at the top of the list.
 - 3) Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.
 - 4) Provide a means to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.
 - 5) Provide a means to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
 - 6) Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.
- k. Equipment Relationships Summary
 - 1) The user interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing.
 - 2) The user interface shall include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.
- l. Equipment Data Summary
 - 1) The user interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format. Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.
 - 2) Provide a means to export a .pdf copy of the report with a single click on the associated export icon.
- m. Equipment Serving Space Summary

- 1) The user interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.
 - 2) The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.
 - 3) Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.
 - 4) Provide a means to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.
 - 5) Provide a means to display specific systems and points by filtering equipment types desired.
 - 6) Because the data is intended to be a snapshot of the current conditions in the space it shall not dynamically update but a click or tap on the update icon at any time performs that function.
- n. Potential Problem Areas Summary
- 1) The user interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.
 - 2) The information shall include:
 - a) Point status (via color)
 - b) Point name
 - c) Value of the point when the summary was taken
 - d) Equipment that contains the offending point
 - e) Space that is served by that equipment
 - 3) Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).
 - 4) The summary may be exported in .csv format for inclusion in spreadsheets or other documents.
- o. Equipment Summary
- 1) The user interface shall provide a summary that allows the user to compare all similar equipment that serves the space as well as downstream (child) spaces in order to evaluate conditions quickly and determine patterns for troubleshooting purposes.
 - 2) Each unique equipment type shall be selectable and display a representative set of values along with the space(s) being served by the device. Equipment types can be selected from a dropdown menu in the summary.
 - 3) Clicking or tapping on a selected device in the summary shall navigate to the home page for that piece of equipment while clicking or tapping a data point shall display the command panel for that point.
 - 4) Provide a means to export a .pdf copy of the currently displayed summary by clicking or tapping on the export icon.
 - 5) Provide a means to create a custom trend graph containing the data shown in the currently displayed summary by clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 6) Provide a means to sort data within the summary by clicking on the desired column heading, allowing to sort from lowest to highest value or vice versa.
- 7) Provide a means to edit the column types and column order within the summary to provide relevant information in accordance with Operators' preferences.
- 8) Provide a means to link to an advanced search and reporting function directly from the Equipment Summary that will pre-populate the advanced report with the data from the Equipment Summary.
- p. User Defined Summaries
 - 1) Provide the capability to view, command, and modify large quantities of similar data in summaries without the use of a secondary application (e.g. a spreadsheet). These summaries shall be generated automatically or user defined.
- q. Trend
 - 1) The user interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.
 - 2) The user shall have the ability to navigate to a selection list of frequently viewed trends.
 - 3) Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.
 - 4) The user shall have the ability to view up to 3 graphs of differing units of measurement in a single screen and select which data points to plot on each to help with readability.
 - 5) Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.
 - 6) Trend graphs shall allow the plotting of non-trended point's default values.
 - 7) The user shall have the ability to add any trended to point a custom trend graph.
 - 8) The user shall have the ability to save trend graphs for reference later.
 - 9) The user shall be able to specify the duration of time and aggregation period for each trend line.
 - 10) The user shall have the ability to decide whether to show raw or aggregate trend data.
- r. Operator Access
 - 1) The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.
 - 2) The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.
- s. Graphics
 - 1) The user interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.

- 2) Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.
 - 3) Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.
 - 4) Provide a means to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.
 - 5) An integral graphic manager shall be provided including the following features and capabilities:
 - a) Creation and modification of graphics from any HTML5 capable browser without the need for additional plug-ins or software packages.
 - b) Access to a full suite of pre-defined templates for air and water sourced HVAC applications as well as the ability to add custom templates as created for other use. Pre-aliased graphic templates may be defined and saved for repetitive representations of common mechanical and electrical equipment.
 - c) A full suite of pre-defined three dimensional symbols for mechanical and electrical systems as well as all line, text and shape tools required for integration into a graphic with zoom and pan capabilities on multiple platforms and in multiple browsers.
 - d) The ability to search and replace items in multiple graphics with a single command.
 - e) The ability to import and insert photos and images into the graphic.
 - f) The ability of the graphics manager to create and edit graphics including the ability to bind graphic elements to the values and conditions of system points in both an on-line and off-line mode.
 - g) The ability to create and import custom SVG symbols that can be selectable from the graphical palette and rendered at runtime.
 - 6) As required, the BAS Contractor shall provide software licenses in the name of the owner for programming, configuration and graphics building tools to allow designated representatives to make changes, modifications or additions to the system. While future updates or revisions may require an update fee, the owner shall incur no additional cost if they choose not to update. Systems that require any annual or time-limited licensing fees shall not be permitted.
- t. Scheduling
- 1) The user interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The

- software should have the ability to display an effective schedule, for the present, or a future date.
- 2) The user interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of viewing individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.
 - 3) The user interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.
- u. Command and Control
- 1) Provide a means to command system analog and binary points via a dropdown menu accessed by clicking or tapping on the value shown in any equipment summary or graphic display and completing the task in the resultant menu including an optional annotation.
 - 2) Commanding multiple points shall be possible on displays where multiple like system elements can be chosen.
 - 3) The user interface shall support users adding notes on their commands.
 - 4) The user interface shall support a choice of either permanent or temporary commands.
- v. Involvement
- 1) The user interface shall provide in a single screen, a way to visualize all interactions (i.e. - commands, writes, references) with a single object.
 - 2) The interface shall provide the ability to filter out any interactions (i.e. commands, writes, references) that are not pertinent.
 - 3) The user interface shall allow seamless navigation between one object's Involvement view to another object's.
- w. System-Level Activity
- 1) The user interface shall provide a timeline view of all audits that occur in the system, including:
 - a) Logins attempts with user specified
 - b) Add, delete, modification of objects
 - c) Commands
- x. Search
- 1) Typing a text string in the Search box shall display a list of all occurrences of that string in the mobile user interface. When a string is represented in the description of a space or network element, selecting it shall display its default dashboard.
 - 2) Clicking or tapping on the Advanced Search Icon shall display the Advanced Search dialog box permitting the following:
 - a) Search by Space and Equipment, Equipment Definition or Network Reference
 - b) Filter the search by wildcard name or object type
 - c) Multi-selection of objects for commanding or the creation of reports including Trend, Alarm, Audit and Activity for a specific period of time

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d) Creation of reports in PDF or CSV formats which can be instantaneously downloaded or emailed, or scheduled to be sent at Operator-selected intervals (daily/weekly/monthly)
 - y. Software Updates
 - 1) Users shall be notified when new software becomes available for download.
 - 2) Users shall be given brief information on what's to be expected in the update.
 - z. Offline Operation
 - 1) The mobile user interface shall have the ability to operate in an offline mode in order to create or edit graphics and dashboard elements.
 - 2) Content created offline shall be available to all authorized users for inclusion of an operating user interface later.
 - aa. Fault Detection
 - 1) Fault detection functionality shall be provided that identifies and displays building system-related faults and lists them color coded in order of severity. This software shall leverage defined rules and a semantic data model to ease configuration.
 - a) The building system fault engine shall run periodically against a minimum of seven days of historical data.
 - bb. Fault Triage
 - 1) Provide a means to display additional information on a particular fault along with corrective actions in the order of their likeliness to resolve the issue, a description of the fault, charting of supporting data, and an activity log to track progress of triage attempts. Functionality shall enhance the sorting order and information in the Faults display to introduce fault occurrences and durations to better drive the most problematic issues to the top of the list.
- D. Associated Application Components
 - 1. Security/Passwords
 - a. Multiple-level passwords access protection shall be provided via roles and permissions. The feature will allow the system to base access on a user's job title or role and allow the user/manager access interface control, display, and database manipulation capabilities based on an assigned password.
 - b. Roles may be copied and altered to meet specific roles and permissions based on the particular policies.
 - c. The system shall allow each user to change his or her password at will.
 - d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
 - e. A maximum of 150 categories may be used to determine or assign areas of responsibilities to each user account.
 - f. A minimum of 100 unique passwords shall be supported.
 - g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
 - h. Operators shall be further limited to only access, command, and modify those buildings, systems, and subsystems for which they have responsibility. Provide a minimum of 100 categories of systems to which individual operators may be assigned.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- i. The system shall automatically generate a report of log-on/log-off and system activity for each user.
 - j. The system shall have the ability to provide a Department of Defense (DoD) specific warning banner for applicable sites that warns the user they are accessing a restricted site.
 - k. After successful login the last time and date that user name was previously logged in is shown on the screen.
 - l. Each login attempt is recorded in the system Audit Log with the option to record the IP address of the PC that made the login.
- 2. Screen Manager
 - a. The system will allow a customized image on the login screen (e.g. organization name, logo).
 - b. User View navigations can be displayed as either a set of tabs or a drop down list.
 - c. Allows user preference for assigning of a background color for when an object is Out of Service which will enable the operator to quickly distinguish points that have been commanded to this state.
 - d. The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.
- 3. Historical trending and data collection
 - a. Each Network Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
 - 1) Any point, physical or calculated, may be designated for trending. Two methods of collection shall be allowed:
 - a) Defined time interval
 - b) Upon a change of value
 - b. Each Network Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.

2.5 NETWORK CONTROL ENGINE (NCE)

- A. Network Control Engine (NCE)
 - 1. The Network Control Engine shall be a fully user-programmable, supervisory controller. The NCE shall monitor the network of equipment controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Engines.
 - 2. The NCE shall also be a fully user-programmable, equipment controller that includes a minimum of 28 I/O points.
 - 3. Automation Network – The NCE(s) shall reside on the automation network and shall support a subnet system controllers via an integral Control network connection.
 - 4. Automation network temporary cellular connection – The BAS shall be provided with a temporary connection via a “master” control engine whereby the Automation network and connected “slave” engines can be accessed remotely before Owner’s IT network is operational. This project shall include at least one connected control engine.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. The connected control engine shall be a standard catalog product of the BAS manufacturer. Non-standard or custom applications are not acceptable.
 - b. This connected control engine shall be panel mounted with a cellular modem, remote antenna and antenna cables, 5 port Ethernet switch, and a power supply with convenience outlet,
 - c. The "master" control engine shall communicate with a temporary Automation Data Server which can be used to remotely load graphics, generate and load database, program, commission and demonstrate the BAS.
 - d. A one-year cellular contract shall be included within this contract at no additional cost to the Owner. Multiple cellular services shall be made available to choose from to allow for best connection strength at the jobsite. The costs of the remote server shall be included within this contract at no additional cost to the Owner.
5. User Interface – Each Network Control Engine shall have the ability to deliver a web-based User Interface previously described. All computers connected physically or virtually to the automation network shall have access to the web-based user interface.
6. Processor – The NCE(s) shall be microprocessor-based with a minimum word size of 32 bits. The Network Control Engine shall be a multi-tasking, multi-user, and real-time digital control process. Standard operating systems shall be employed. NCE(s) size and capability shall be sufficient to fully meet the requirements of this Specification.
7. Memory – Each NCE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
8. Secure Boot – The NCE shall prevent malicious or unauthorized software applications from loading during the system startup process.
9. Background File Transfer – The NCE shall provide the capability to download a new image and database to a network engine while the engine is still running and controlling the building.
10. User Authentication – The NCE shall support local user authentication.
11. Password Security – Access to the Network Control Engines' embedded user interface shall require a password of 8 to 50 characters including a minimum of one lower case letter, one upper case letter, one number, and one special character. An alarm shall be generated after three unsuccessful attempts within 15 minutes and the user shall be denied access until permission is renewed by a system administrator.
12. Network Security – Communication between the NCE and other system networked devices including additional Network Engines, Application and Data Servers, Open Data Servers (BACnet listed OWS), and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates. Engines shall also be equipped to optionally support FIPS 140-2 Federal Government encryption standard.
13. Hardware Real Time Clock – The Network Control Engine shall include an integrated, hardware-based, real-time clock, with a supercapacitor to maintain time for a minimum of 72 hours during a power loss. Controllers using a battery to maintain time during a power loss shall not be acceptable.

14. Diagnostics – The NCE(s) shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The NCE(s) shall provide both local and remote annunciation of any detected component failures or repeated failures to establish communication.
15. Power Failure – In the event of the loss of normal power, the NCE(s) shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
 - a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
 - b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
16. Certification – The NCE(s) shall meet and be listed to the UL 916 Standard for Energy Management Equipment and be FCC Compliant to CFR47, Part 15, Subpart B, Class A.
17. Device Integration – The NCE(s) shall support integrating and supervising networked devices using the following communication protocols on the device/controller network:
 - a. The NCE (s) shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135 on the controller network.
 - 1) The NCE (s) shall support Remote Field Bus integration via a BACnet IP to MS/TP router.
 - 2) The NCE (s) shall be tested and BTL listed/certified as a BACnet Building Controller (B-BC).
 - 3) A BACnet Protocol Implementation Conformance Statement shall be provided for the NCE(s).
 - b. The NCE(s) shall optionally support integration of networked devices using the following networking protocols:
 - 1) BACnet
 - 2) Johnson Controls N2 or third party N2 Open devices.
 - 3) LonTalk
 - 4) MODBUS RTU
 - 5) MODBUS TCP
 - 6) KNX
 - 7) M-Bus
 - 8) OPC UA
18. The NCE shall employ a finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
19. The NCE shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only, shall not be acceptable.
20. The NCE shall support the following types of inputs and outputs:
 - a. Universal Inputs – shall be configured to monitor any of the following for Analog inputs: Voltage Mode, Current Mode, Resistive Mode. For Binary Inputs: Dry Contact Maintained Mode, Pulse Counter Mode

- b. Analog Outputs – shall be configured to output either of the following:
Voltage Mode, Current Mode
 - c. Binary Outputs – shall output the following: 24VAC Triac
 - d. Configurable Outputs – shall be configured to output either of the following:
 - 1) Analog Output Voltage Mode
 - 2) Binary Output 24 VAC Triac Mode
 - e. The NCE shall have the ability to monitor and control a network of sensors and actuators over a Sensor Actuator (SA) Bus dedicated to the controller. This bus shall be a MS/TP Bus supporting BACnet Standard protocol SSPC-135 supporting no less than 9 devices with a maximum distance of 1,200 Ft. between the NCE and the furthest connected device.
- 21. The NCE shall provide removable, labeled, screw terminal blocks for 24 VAC power, communication bus and I/O point field wiring.
 - 22. The NCE shall include the following multi-color, flashing LEDs to indicate important operating conditions and status
 - 23. Communications Ports – The NCE(s) shall provide the following ports for connecting networkable devices:
 - a. Two (2) USB ports
 - b. One (1) RS-485 port
 - c. Two (2) Ethernet ports
 - 24. The NCE shall support an integrated user interface featuring a display and keypad in lieu of on-board HOA switches for output overrides.
 - a. The integrated user interface shall allow viewing and monitoring points, alarms, and trends.
 - b. The integrated user interface shall allow viewing and changing setpoints, modes of operation, and parameters.
 - c. The integrated user interface shall provide password protection with user-adjustable password timeout.
 - d. The information presented by the integrated user interface shall be organized into folders for easy navigation.
 - e. The integrated user interface shall support textual descriptions in English for each point.
 - f. The display shall be, at minimum, a 2.4-inch, color display with 320x240 resolution.
 - g. The display shall support adjustable contrast and brightness.
 - h. The keypad shall include no more than seven (7) keys.
 - 25. The NCE shall support up to 50 supervised devices across all supported integrations.

2.6 DDC EQUIPMENT CONTROLLERS

- A. General Purpose Application Controller (GPAC)
 - 1. The General Purpose Application Controller (GPAC) shall be a fully programmable, digital controller that communicates via the BACnet MS/TP protocol over the FC Bus.
 - a. The GPAC shall support BACnet Standard ANSI/ASHRAE 135.
 - 1) The GPAC shall be BTL listed/certified.
 - 2) The GPAC shall be tested and certified as a BACnet Advanced Application Controller (B-AAC).

- 3) A BACnet Protocol Implementation Conformance Statement shall be provided for the GPAC.
2. The GPAC shall employ finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
3. GPAC shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
4. The GPAC shall be assembled in a plastic housing with protection class IP20 (IEC529) and flammability rated to UL94-5VB.
5. The GPAC shall include an integral real-time clock and support time-based tasks which enables these field controllers to monitor and control schedules, calendars, alarms, and trends.
6. The GPAC can continue time-based monitoring when offline for extended periods of time from a network.
7. The GPAC can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the equipment controllers.
8. The GPAC shall include troubleshooting LEDs to indicate the following conditions normal or abnormal operation of power, controller fault, SA bus communications, FC Bus communications, and end of line on/off.
9. The GPAC shall have the ability to transfer and apply firmware files to all SA Bus devices (EOIM, IOM, and networked zone sensors) connected to it.
10. The GPAC shall include removable and labeled screw terminal blocks for all I/O, FC and SA Bus communication, and power wiring connections.
11. The GPAC shall accommodate the direct wiring of analog and binary I/O field points with the following resolution.
 - a. Inputs – 24-bit analog-to-digital converter
 - b. Outputs – +/- 200 mV accuracy in 0-10 VDC applications
12. The GPAC shall support the following types of inputs and outputs supplied in the amounts required for the specified applications:
 - a. Universal Inputs – 0-10 VDC analog input, 4-20 mA analog input, 0-600k ohms analog input, Dry contact binary input
 - b. Binary Inputs – Dry Contact Maintained Mode, Pulse Counter Mode
 - c. Analog Outputs – 0-10 VDC analog output, 4-20 mA analog output
 - d. Binary Outputs – 24 VAC Triac
 - e. Configurable Outputs – 0-10 VDC analog output, 24 VAC Triac binary output
13. The GPAC shall have the ability to monitor and control a network of sensors and actuators over a SA Bus.
14. The GPAC shall include three (3) decimal rotary dial switches for setting the BACnet MS/TP device address.
15. The GPAC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over a MS/TP Bus.
16. The GPAC shall support a Local Controller Display as a remote device communicating over the SA Bus.
 - a. The Display shall use a BACnet Standard SSPC-135 MS/TP protocol.

- b. The Display shall allow the user to view monitored points without logging into the system.
- c. The Display shall allow the user to view and change setpoints, modes of operation, and parameters.
- d. The Display shall provide password protection with user adjustable password timeout.
- e. The Display shall be menu driven with separate paths for:
 - 1) Input/Output
 - 2) Parameter/Setpoint
 - 3) Overrides
- f. The Display shall use easy-to-read English text messages.
- g. The Display shall allow the user to select the points to be shown and in what order.
- h. The Display shall support a back lit LCD with adjustable contrast and brightens and automatic backlight brightening during user interaction.
- i. The Display shall have a keypad.
- j. The Display shall be panel mountable.

2.7 FIELD DEVICES

A. Expansion Input/Output Module (EIOM)

- 1. The EIOM provides additional input and output interfaces for use in digital controllers.
- 2. The EIOM shall communicate with controllers over the FC Bus or the SA Bus.
- 3. The EIOM shall support BACnet Standard ANSI/ASHRAE 135.
 - a. The EIOM shall be BTL listed/certified and carry the BTL Label.
 - b. The EIOM shall be tested and certified as a BACnet Smart Actuator (B-SA).
 - c. A BACnet Protocol Implementation Conformance Statement shall be provided for the IOM.
- 4. The EIOM shall include removable screw terminal blocks for all I/O, SA/FC bus communication, and power wiring connections.
- 5. The EIOM shall include three (3) decimal rotary dial switches for setting the BACnet MS/TP device address.
- 6. The IOM shall accommodate the direct wiring of analog and binary I/O field points with the following resolution:
 - a. Inputs – 24-bit analog-to-digital converter
 - b. Outputs – +/- 200 mV accuracy in 0-10 VDC applications
- 7. The EIOM shall support the following types of inputs and outputs:
 - a. Universal Inputs – 0-10 VDC analog input, 4-20 mA analog input, 0-600k ohms analog input, Dry contact binary input
 - b. Binary Inputs – Dry Contact Maintained Mode, Pulse Counter Mode
 - c. Analog Outputs – 0-10 VDC analog output, 4-20 mA analog output
 - d. Binary Outputs – 24 VAC Triac
 - e. Configurable Outputs – 0-10 VDC analog output, 24 VAC Triac binary output
- 8. The EIOM shall include troubleshooting LEDs to indicate the following conditions normal or abnormal operation of power, controller fault, SA bus communications, FC Bus communications, and end of line on/off.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

B. Networked Thermostat (TEC)

1. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.
 - a. Two-line, 8 character backlit display
 - b. LED indicators for Fan, Heat, and Cool status
 - c. Five (5) User Interface Keys
 - 1) Mode
 - 2) Fan
 - 3) Override
 - 4) Degrees C/F
 - 5) Up/Down
2. The Networked Thermostats shall provide the flexibility to support the following inputs:
 - a. Integral Indoor Air Temperature Sensor
 - b. Duct Mount Air Temperature Sensor
 - c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.
 - d. Two configurable binary inputs
3. The Networked Thermostats shall provide the flexibility to support the following outputs:
 - a. Three Speed Fan Control
 - b. On/Off Control
 - c. Floating Control
 - d. Proportional (0 to 10V) Control

C. Network Sensors (NS)

1. The Network Sensors (NS) shall have the ability to monitor the following variables all within a single wall-mounted enclosure (no exceptions) as required by the systems sequence of operations:
 - a. Zone temperature
 - b. Zone humidity
 - c. Zone carbon dioxide
 - d. Zone set point
2. The NS shall transmit the zone information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135.
3. The NS shall be BTL listed/certified and carry the BTL Label.
 - a. The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
4. The Network Zone Temperature Sensors shall include the following items:
 - a. A backlit LCD to indicate the temperature, humidity and setpoint
 - b. An LED to indicate the status of the Override feature
 - c. A button to toggle the temperature display between Fahrenheit and Celsius
 - d. A button to program the display for temperature or humidity
 - e. A button to initiate a timed override command
 - f. Available in either surface mount, wall mount, or flush mount
 - g. Available with either screw terminals or phone jack

D. VAV Box Controller (VBC)

1. The VAV Box Controller (VBC) shall provide both standalone and networked DDC of pressure independent, VAV terminal units.
2. The VBC controller shall be a fully programmable, digital controller that communicates via BACnet MS/TP protocol over the FC Bus.

- a. The VBC shall support BACnet Standard ANSI/ASHRAE 135.
 - 1) The VBC shall be BTL listed/certified.
 - 2) The VBC shall be tested and certified as a BACnet Advanced Application Controller (B-AAC).
 - 3) A BACnet Protocol Implementation Conformance Statement shall be provided for the VBC.
3. The VBC shall include 14 preloaded single duct VAV box control applications to allow the VBC to be made fully operational without the need to create a custom program.
4. The VBC shall employ finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
5. The VBC shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
6. The VBC shall be assembled in a plenum-rated plastic housing with protection class IP20 (IEC529) and flammability rated to UL94-5VB.
 - a. The VBC shall include an integral real-time clock and support time-based tasks which enables these equipment controllers to monitor and control schedules, calendars, alarms, and trends
7. The VBC can continue time-based monitoring when offline for extended periods of time from a network.
8. The VBC shall include an integral differential pressure transducer and damper actuator. An additional configuration option shall be available that also includes an integral potentiometer for actual damper position feedback. All components shall be connected and mounted as a single assembly, removable as one piece.
9. The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in 60 seconds for quick damper positioning to speed commissioning and troubleshooting tasks.
10. The VBC shall determine airflow by a state-of-the-art, digital, non-flow pressure sensor that supports automatic correction for polarity on high- and low-pressure DP tube connections to eliminate high- and low-pressure connection mistakes.
11. The VBC shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature / humidity effects.
12. The VBC can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the equipment controllers.
13. The VBC shall include troubleshooting LEDs to indicate the following conditions normal or abnormal operation of power, controller fault, SA bus communications, FC Bus communications, and end of line on/off.
14. The VBC shall have the ability to transfer and apply firmware files to all SA Bus devices (EOIM, IOM, and Networked zone sensors) connected to it.
15. The VBC shall include removable screw terminal blocks for all I/O, FC and SA Bus communication, and power wiring connections.
16. The VBC shall accommodate the direct wiring of analog and binary I/O field points with the following resolution.

- a. Inputs – 24-bit analog-to-digital converter
- b. Outputs – +/- 200 mV accuracy in 0-10 VDC applications
- 17. The VBC shall support the following types of inputs and outputs supplied in the amounts required for the specified applications:
 - a. Universal Inputs – 0-10 VDC analog input, 4-20 mA analog input, 0-600k ohms analog input, Dry contact binary input
 - b. Binary Inputs – Dry Contact Maintained Mode, Pulse Counter Mode
 - c. Analog Outputs – 0-10 VDC analog output, 4-20 mA analog output
 - d. Binary Outputs – 24 VAC Triac
 - e. Configurable Outputs – 0-10 VDC analog output, 24 VAC Triac binary output
- 18. The VBC shall have the ability to monitor and control a network of sensors and actuators over a SA Bus.
- 19. The VBC shall include three (3) decimal rotary dial switches for setting the BACnet MS/TP device address.
- 20. The VBC shall have the capability to execute VAV box control sequences involving direct wired I/O points as well as input and output devices communicating over the SA or FC buses.
- 21. The controller shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.
- 22. Each controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. In addition, this tuning reduces commissioning costs, and eliminates the maintenance costs of manually re-tuning loops to compensate for seasonal or other load changes.
- 23. The controller shall provide the ability to download and upload VAV box control application configuration files, both locally and via the FC Bus. Controllers shall be able to be loaded individually or as a group.
- 24. Control setpoint changes initiated over the network shall be written to VBC non-volatile memory.
- 25. The VBC controller firmware shall be flash-upgradeable remotely via the FC bus.
- 26. The VBC controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
- 27. The VBC controller shall interface with balancer tools that allow automatic recalculation of box flow pickup gain ("K" factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.
- 28. The VBC controller shall have on-board diagnostics. These diagnostics shall consist of control loop performance measurements executing at each control loop's sample interval, which may be used to continuously monitor and document system performance. The VBC shall calculate Exponentially Weighted Moving Averages (EWMA) for each of the following metrics, which shall be available to the end user for efficient management of the VAV terminals.
- 29. The controller shall detect system error conditions to assist in managing the VAV zones.
- 30. The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The VBC would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

31. The VBC controller shall provide a compliant interface for ASHRAE Standard 62-1989 (indoor air quality) and shall be capable of resetting the box minimum airflow based on the percent of outdoor air in the primary air stream.
32. The VBC controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.

E. System Tools

1. One software copy of each system tool shall be provided with the BAS.
2. System Configuration Tool
 - a. The Configuration Tool shall be a software package enabling a computer platform to be used as a stand-alone engineering configuration tool for a Network Engine.
 - b. The configuration tool shall provide an archive database for the configuration and application data.
 - c. The configuration tool shall provide a site discovery feature to automatically discover field devices on connected buses and networks. Automatic discovery shall be available for the following field devices:
 - 1) BACnet Devices
 - 2) LonWorks devices
 - 3) Johnson Controls N2 Bus devices
 - d. A wireless access point shall allow a wireless enabled portable PC to make a temporary Ethernet connection to the automation network.
 - e. Provide Johnson Controls SCT or approved equal.
3. Controller Configuration Tool (CCT)
 - a. As part of the single software tool environment including system and controller elements, the Controller Configuration Tool (CCT) shall be used to configure, simulate and commission equipment controllers and NCE controllers.
 - b. The CCT shall operate in distinct modes to facilitate efficiency at various steps in the steps leading to project completion as well as future upgrades and maintenance
 - c. The configuration tool shall be capable of programming the Equipment Controllers.
 - 1) The configuration tool shall provide the capability to configure, simulate, and commission the Equipment Controllers.
 - 2) The configuration tool shall allow the equipment controllers to be run in Simulation Mode to verify the applications.
 - 3) The configuration tool shall contain a library of standard applications to be used for configuration.
 - d. The CCT shall provide multiple options for downloading files to the controllers including direct wired, wireless and Ethernet pass thru as dictated by controller type and location.

2.8 LABORATORY CONTROL SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide laboratory control system by [insert manufacturer] or comparable product by one of the following:
 1. Antec Controls (Price)

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Automated Logic Corporation
 3. Johnson Controls, Inc.
 4. Phoenix Controls
 5. Siemens Building Technologies, Inc.
 6. Trane
 7. In accordance with this specification, alternative laboratory airflow control systems and equipment shall be considered for approval provided that the equipment be equal to the operational characteristics, capacities, and intent of control sequences specified herein. Approval to bid does not relieve the laboratory airflow control system supplier from complying with the minimum requirements or intent of this specification.
- B. The Laboratory Control System (LCS) shall be fully integrated to the HVAC Instrumentation and Controls System to maintain laboratory room supply and exhaust airflows, room ventilation rates, room static pressurization, room ambient temperatures & humidity's and the laboratory exhaust system functionality as specified herein.
- C. The LCS shall include all laboratory room supply and exhaust airflow terminals, fume hood airflow terminals, reheat coils, reheat coil valves, air terminal actuators, sensors, associated instrumentation and the control units and associated interconnecting wiring and pneumatic tubing. Any and all associated components required to implement a fully functioning and integrated system as specified herein shall also be provided. System verification and other documentation as specified under the Sections referenced herein shall also be included.
- D. All LCS data shall be capable of being accessed by authorized persons via the facility HVAC control system to obtain LCS data in graphical form as well as in specific user defined and configured LCS summary and status reports.
- E. Methods of integration shall be as defined elsewhere in this Section.
- F. Use new products that the manufacturer is currently manufacturing and that have been installed in similar installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner or Owner's representative. Spare parts shall be available for at least five years after completion of this contract.
- G. Laboratory Controllers
1. CAV/2-State Auxiliary Exhaust Device Controllers
 - a. Provide a UL 916 listed controller where shown on drawings for constant volume-2 state (CV2) auxiliary exhaust devices (i.e., canopy hoods, snorkels etc). Exhaust air shall be controlled at two individual setpoints corresponding to switch/software command as indicated in Part 3, Sequence of Controls. The exhaust control process shall maintain exhaust at its respective setpoint in response to actual exhaust airflow measurement to ensure full pressure independent closed loop control using a proportional, integral and derivative (PID) control algorithm.
 - b. Controller shall be capable of receiving status override functions as defined in sequence of operations.
 - c. The controller shall provide a continuous hardwired flow signal to the Lab Room Controller indicating exhaust airflow to ensure stand-alone flow

- tracking. If the control function is directly connected to the Lab Room Controller, a dedicated controller is not required.
- d. Provide an Operator Display Panel (ODP) located at the designated height near the exhaust device(s). The ODP will provide the following functions.
 - 1) Provide the switchover function for two-state control (i.e., occupied/unoccupied, on/off etc).
 - 2) Provide audible/visual alarm indication for exhaust airflow.
 - 3) Provide a silence switch.
 - 4) Provide an operator interface to the controller.
- 2. VAV/CAV General Lab Room Controllers
 - a. Laboratory room controllers shall provide closed loop pressure independent control of all laboratory room ventilation and ambient requirements. The laboratory room controller shall continuously monitor all the supply and auxiliary exhaust airflow devices including VAV fume hoods in the room.
 - b. Pressure control algorithm shall control supply and exhaust airflow devices in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. The offset shall be field adjustable and represents the volume of air which will enter (or exit) the room from the corridor or adjacent spaces
 - c. Unless specifically indicated within the sequence of operation, volumetric offset shall be the only acceptable means of controlling room pressurization. Systems that rely on differential pressure as a means of control shall provide documentation that space pressurization can be maintained if fume hood sashes are changed at the same time a door to the space is opened.
 - d. Room ambient control (temperature, humidity etc.) and any other room control functions (lighting, IAQ etc.) shall be maintained by the controller as indicated in the sequence of operations.
 - e. All laboratory room controllers shall include all inputs and control outputs necessary to perform the specified control sequences. Each laboratory room controller shall operate as a standalone unit, performing its specified control responsibilities independently. All input point and control output point databases as well as the control programs shall be stored in non-volatile EEPROM, EPROM and PROM memory, or a minimum of 100-hour battery backup shall be provided.
 - f. Momentary or extended losses of power shall not change or affect any laboratory room controller setpoints or stored data. Upon resumption of power the controller shall resume full normal operation exactly as before without any need for manual intervention. Upon a power failure or operational failure within the controller, the air terminal shall automatically be positioned to the predetermined fully open or fully closed (failsafe) position as indicated on the air terminal schedules in the project plans.
 - g. All laboratory room controllers shall include the ability to accept a minimum of two dry contact closure inputs from an auxiliary source into the room control sequence for such purposes as occupied/unoccupied ventilation changeover, emergency mode sequences, etc.
 - h. All laboratory room controllers shall provide a general alarm output that may be used for auxiliary signaling or notification.

H. Laboratory VAV/CAV Air Terminals

1. Single Blade Damper - Closed Loop Control
 - a. Provide industrial grade Terminal Units with construction, leakage, and performance as stated within. Commercial grade terminal units are not acceptable. Units not conforming to all construction and performance criteria listed herein will be rejected.
 - b. Laboratory Terminals shall have a single blade damper for airflow adjustment and shall provide the individual airflow capacities indicated in the project airflow schedules. Terminal airflow shall be pressure independently controlled using actual independent airflow measurement feedback as an integral part of a closed loop control process.
 - c. Minimum airflow sensor measurement accuracy shall be +/- 5% of actual airflow over the entire design airflow range of each air terminal. Airflow measurement accuracy substantiation by a qualified independent test agency shall be available upon request.
 - d. Airflow transmitter shall be factory mounted on the terminal and shall include the necessary signal conditioning/transmitter instrumentation to provide an output proportional to the velocity pressure. Transmitter shall have an accuracy of at least +/- 0.5% of the transmitter range and a drift no greater than 0.5% full scale/year Transmitter ranges shall not exceed 0 to 1.00 Inches W.C. High and low limits shall be fully adjustable. Transmitters not meeting the drift requirements shall be provided with an auto-zero solenoid that connects to the air velocity pressure transducer's inlet ports for enabling automatic periodic re-calibration to ensure drift-free airflow measurement. Automatic re-calibration shall occur at a minimum every 24 hours without airflow disruption to the space.
 - e. All single blade damper air terminals shall have a wide open pressure drop less than 0.25" wc at airflow equivalent to 2000 fpm inlet duct velocity.
 - f. Room supply air terminals shall be industrial grade and constructed of 22 gauge galvanized steel with mechanically locked and gasketed seams and shall meet the mechanical standards of and be in compliance with UL 181 and UL 723, NFPA 90A, ESTM E84 and bacteria standard ASTM C665. Air terminal casings shall have 3/4" thick fiber-free closed cell foam insulation. Damper shafts shall be solid 1/2" diameter zinc-plated steel with self-lubricating polyethylene bushings and with external indication of the damper position. Damper blades shall be 22 gauge steel with a polyurethane foam gasket to enable tight shutoff for smoke control applications. Air terminal leakage shall not exceed 1% @ 6 inches W.C. positive static pressure of the airflow corresponding to 2000 fpm inlet duct velocity. Dampers 16" diameter and less shall be capable of a total shut off of room supply airflow (leakage to be less than 1% of airflow corresponding to 2000 fpm inlet duct velocity). Supply air terminals shall be provided with an averaging pitot tube array type of airflow sensor located upstream from all other air terminal components. Supply terminals shall be provided with integral hot water reheat coils comprised of copper tubing of 0.017" wall thickness and have heavy gauge sine wave coil fins for efficient heat transfer meeting scheduled capacities. The supply terminals shall be certified under ARI-880, and display the ARI label.
 - g. Room general exhaust air terminals including the damper blades shall be industrial grade and constructed of minimum 22 gauge galvanized steel. Damper shafts shall be 1/2" diameter zinc-plated steel with self-lubricating Teflon bushings and with external indication of the damper position.

Terminal air leakage shall not exceed 1% of design airflow @ 6 inches W.C. positive static pressure. Room general exhaust air terminals shall be provided with an orifice ring type of airflow sensor located upstream of the damper.

- h. All fume hood exhaust terminals shall be constructed of minimum 20 gauge, Type 304 or 316 stainless steel, with all materials exposed to the airstream provided with a baked on Phenolic, PTFE or PFA coating. Damper shafts shall be ½" diameter coated stainless steel with self-lubricating Teflon bushings and with external indication of the damper position. Fume hood exhaust terminals shall be provided with an orifice ring type of airflow sensor located upstream of the damper. Airflow sensing techniques that are likely to become inoperative due to accumulation of particulate or chemical deposits or which can catch debris and obstruct exhaust airflow shall not be acceptable for fume hood exhaust applications. Unacceptable airflow measurement sensors for fume hood exhaust air terminals include pitot tubes, vortex shedders, thermal anemometers and other devices that protrude into the center of the exhaust air stream.
- i. Discharge and radiated sound power level data shall be provided for each different size and type of air terminal as part of the submittal documentation. Sound power data shall be obtained in accordance with ANSI/ASHRAE 130-1995 Standard Methods of Testing for Rating Ducted Air Terminal Units. All sound data shall be obtained by a qualified, accredited and ARI approved testing laboratory.

I. Airflow Control Sound Specifications:

1. Unless otherwise specified the airflow control device shall not exceed the sound power levels in Table 1, Table 2, or Table 3.
2. If the airflow control device cannot meet the sound power level specification, a properly sized silencer or sound attenuator must be used. All silencers must be of a packless design (constructed of at least 18 gauge 316L stainless steel when used with fume hood exhaust) with a maximum pressure drop at the device's maximum rated flow rate not to exceed 0.20 inches of water.
3. All proposed airflow control devices shall include discharge, exhaust, and radiated sound power level performance.
4. Table 1. Exhaust Airflow Control Device Sound Power Level (Airborne).

	Exhaust Sound Power Level in dB (re: 10 ⁻¹² watts)					
Octave Band Number	2	3	4	5	6	7
Center Frequency in Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1000-50 cfm Device						
800 cfm @ 0.6" wc	63	55	52	54	50	49
200 cfm @ 0.6" wc	46	42	38	37	32	25
800 cfm @ 3.0" wc	73	70	64	66	65	60
200 cfm @ 3.0" wc	51	52	51	50	52	51
1500-100 cfm Device						

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1200 cfm @ 0.6" wc	65	58	53	56	52	52
400 cfm @ 0.6" wc	50	45	38	39	37	31
1200 cfm @ 3.0" wc	72	70	62	65	64	60
400 cfm @ 3.0" wc	55	57	55	53	56	55
3000-200 cfm Device						
2400 cfm @ 0.6" wc	63	56	55	58	54	55
800 cfm @ 0.6" wc	51	45	41	42	39	34
2400 cfm @ 3.0" wc	74	71	65	69	67	63
800 cfm @ 3.0" wc	58	58	56	56	59	58

5. Table 2. Supply Airflow Control Device Sound Power Level (Airborne)

	Discharge Sound Power Level in dB (re: 10 ⁻¹² watts)					
Octave Band Number	2	3	4	5	6	7
Center Frequency in Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1000-50 cfm Device						
800 cfm @ 0.6" wc	62	57	54	58	54	51
200 cfm @ 0.6" wc	45	46	42	44	40	34
800 cfm @ 3.0" wc	72	71	67	75	72	68
200 cfm @ 3.0" wc	53	56	54	58	56	54
1500-100 cfm Device						
1200 cfm @ 0.6" wc	63	59	55	60	54	53
400 cfm @ 0.6" wc	53	49	44	49	45	39
1200 cfm @ 3.0" wc	72	73	69	77	72	68
400 cfm @ 3.0" wc	58	63	61	63	60	57
3000-200 cfm Device						
2400 cfm @ 0.6" wc	64	60	58	63	56	56
800 cfm @ 0.6" wc	52	48	47	52	46	41
2400 cfm @ 3.0" wc	75	75	72	78	73	70
800 cfm @ 3.0" wc	59	62	62	66	62	60

6. Table 3. Supply Airflow Control Device Sound Power Level (Radiated)

	Radiated Sound Power Level in dB (re: 10 ⁻¹² watts)
--	--

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

Octave Band Number	2	3	4	5	6	7
Center Frequency in Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1000-50 cfm Device						
800 cfm @ 0.6" wc	44	41	45	41	36	34
200 cfm @ 0.6" wc	33	28	31	29	26	20
800 cfm @ 3.0" wc	53	53	56	57	55	53
200 cfm @ 3.0" wc	41	38	41	39	39	37
1500-100 cfm Device						
1200 cfm @ 0.6" wc	47	53	40	42	38	36
400 cfm @ 0.6" wc	35	39	31	34	33	26
1200 cfm @ 3.0" wc	52	60	54	60	59	53
400 cfm @ 3.0" wc	42	44	43	46	46	42
3000-200 cfm Device						
2400 cfm @ 0.6" wc	58	56	45	47	43	42
800 cfm @ 0.6" wc	45	43	36	39	37	29
2400 cfm @ 3.0" wc	69	68	60	65	63	57
800 cfm @ 3.0" wc	54	53	48	51	50	48

J. Laboratory Terminal Unit Electric Actuators

1. General: Provide high-speed electronic actuators for all supply and exhaust type terminals serving spaces with VAV fume hoods. All other terminals shall be provided with standard electronic actuators as specified herein. All actuators shall be factory mounted on terminals.
2. For high-speed actuators, the flow response time from 0 to 90% flow shall be no greater than 1 second under normal conditions when used with either a terminal box single blade damper or venturi air valve.
3. All actuators shall be provided with a manual override feature allowing the end user to stroke the damper to either the full open or full closed position. Actuators shall be capable of either floating control or analog (0-10Vdc, 4-20mA) control, as needed by the Laboratory application.
4. Fail-safe position shall be as indicated in sequence of operation/control drawings specified herein. Failure mode shall be field selectable via dipswitches.

K. Occupancy Sensor

1. Occupancy sensors shall use a combination Passive Infrared (PIR) and Microwave technology with continuous monitoring and built-in diagnostics. Ceiling mounted units shall have 360 deg field-of-view.
2. Basis of design: IntelliSense DT-6360STC

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- L. Control valves: As specified elsewhere under this Section.
- M. Sensors and Binary Devices: As specified elsewhere under this Section.
- N. Miscellaneous control devices: All other control devices not specifically identified under Laboratory Control System shall meet specific item requirements listed elsewhere under this Section.
- O. Reheat Coils: Laboratory supply terminal units shall be provided with a SCR controlled electric reheat coil. The control of the reheat coil shall be in conjunction with the terminal unit control. The terminal unit controller shall be responsible for the control of the reheat coil.
- P. Installation: The automatic temperature controls (ATC) contractor shall install the sash sensors, interface boxes, presence and motion sensor, and fume hood monitor on the fume hood under initial supervision of the laboratory airflow control system supplier. Reel-type sash sensors and their stainless steel cables shall be hidden from view. Bar-type sash sensors shall be affixed to the individual sash panels. Sash interface boxes with interface cards shall be mounted in an accessible location.
 - 1. The ATC contractor shall install the laboratory control unit (if panel-mounted) and wall-mounted power supply (as required) in an accessible location in the designated laboratory room.
 - 2. The ATC contractor shall terminate and connect all cables as required. In addition, integrated laboratory control unit connectors shall be furnished by the ATC.
 - 3. The mechanical contractor shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages.
 - 4. The mechanical contractor shall provide and install all reheat coils and transitions.
 - 5. The mechanical contractor shall provide and install insulation as required.
 - 6. The Division 26 Contractor (Electrical Contractor) shall provide 120 volt power in the laboratory ceiling spaces for connection to the laboratory control system equipment or where indicated on Division 26 drawings. It shall be the responsibility of this contractor to provide 24 VAC power where required by the LACS and associated control devices.
 - 7. Air Terminals, Reheat Coils and Control Valves
 - a. LACS contractor shall furnish all laboratory air terminals, reheat coils (if separate from the air terminal) and control valves to the Div 23 contractor for installation. Div 23 contractor shall provide necessary ductwork/piping transitions as required for mounting equipment furnished by the LACS contractor
 - b. Actuators shall be mounted on the same side of air terminals as coil connections to ensure service access
 - c. Access door shall be provided at inlet side of coil by the Div 23 contractor.
 - 8. Fume Hood Controls
 - a. Coordinate all requirements with the fume hood manufacturer
 - b. Furnish templates to the fume hood manufacturer for any devices requiring fume hood mounting. Fume hood manufacturer shall provide necessary cut outs with blank cover plates.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Verify any sash sensor requirements with the fume hood manufacturer based on fume hood size, sash configuration and installation requirements for each device.
 - d. LACS contractor shall field install, mount and wired required hood mounted devices.
- 9. Occupancy sensors
 - a. Install sensors to provide full coverage of the intended space. Coordinate with the Engineer if locations shown on drawings will not provide full coverage prior to installation.
- Q. LACS System Checkout and Testing
 - 1. System startup shall be provided by factory certified and trained employees of the LACS manufacturer. 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. Start up shall include the following tasks:
 - a. Determine when the HVAC equipment and each room is ready for ventilation system operational testing.
 - b. Furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
 - c. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
 - d. 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.
 - e. Alarms and Interlocks:
 - 1) Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
 - 2) 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.
 - 3) Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.
 - f. Set up all laboratory room and fume hood controllers and verify that all controlled parameters are being maintained at the required setpoint and that all associated operational aspects including measurement accuracies, alarm criteria, high-low limits, time delays, etc. are functioning in accord with the specified performance. The Testing Adjusting and Balancing (TAB) agent shall verify that all airflows are within the specified requirements and any departure from the specified performance shall be corrected and verified by the LACS to ensure all aspects of the control system are in full conformance with these specifications. The setup and verification process shall cover:
 - 1) Fume hood face velocity and/or fume hood exhaust airflow rate control.
 - 2) Fume hood high and low alarms
 - 3) Room supply and exhaust airflows and the room ventilation rate control
 - 4) Room static pressurization control and associated operational criteria.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 5) Room ambient temperature control
 - 6) Room/zone humidity control
 - 7) Room emergency control sequences
 - 8) Laboratory facility centralized exhaust system static pressure, exhaust stack velocity and associated exhaust system functionality
 2. All operational aspects of the LACS performance shall be formally recorded when verified and a copy of the recorded data shall be provided to the owner as part of the as-built documentation.
- R. Building Automation System Interface
 1. All points shall be provided to and from the BAS.
 2. Information shall be communicated by seamless LAN connections.
- S. LACS System Demonstration and Acceptance
 1. Demonstration
 - a. 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.
 - b. 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.
 - c. The demonstration process shall follow that approved in "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
 - d. The LACS supplier shall provide a functional demonstration on the LACS operation to owner designated representatives as well as other interested participants which may include the architect, engineer, as well as the general and mechanical contractors. This demonstration shall include any LACS control sequences selected by the owners representatives and may cover several laboratory rooms. Demonstration items that may be included (but not limited to) shall include fume hood and room airflow control, room pressurization control, exhaust system functionality, emergency functions and associated local monitoring provisions as well as required BAS monitoring and alarm reporting. The day for this demonstration shall be established by the owner's representatives in conjunction with the other participants.
 2. Acceptance
 - a. 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.
 - b. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved.
 3. Training

- a. The LACS contractor shall provide on-site instruction for up to six (6) owner designated personnel covering all aspects of the operation and use of the LACS including operator interface, control parameter setpoint adjustment, alarm limit and time delay adjustments, point trending, automatic startup, shutdown and changeover scheduling as well as the manipulation and utilization of all associated LACS monitoring and control functions. The training shall be augmented with an operational manual for each attendee and shall also include the recommended procedures to verify the proper functioning of the LACS. Instructors shall be highly qualified factory trained personnel who reside at the local branch office of the LACS supplier and who are thoroughly familiar with all aspects of the overall subject matter and this specific facility's LACS. All training shall be provided on weekdays during the normal daytime working hours of the facility operations personnel.
- b. Training shall consist of not less than 8 hours for designated personnel.
- c. Additional specialized operational training courses shall be made available to facility personnel covering the LACS and its components.

2.9 INPUT DEVICES

A. General Requirements

- 1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature Sensors

- 1. General Requirements:
 - a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
 - b. The temperature sensor shall be of the resistance type and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
 - c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:
- 2. Room Temperature Sensors
 - a. Room sensors shall be constructed for either surface or wall box mounting.
 - b. Room sensors shall have the following options when specified:
 - 1) Set point reset providing a +3 degree (adjustable) range.
 - 2) Individual heating/cooling set point slide switches.
 - 3) A momentary override request push button for activation of after-hours operation.
 - c. Provide digital display of sensed temperature.
- 3. Thermo wells
 - a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
 - b. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
 - c. Thermo wells and sensors shall be mounted in a threadolet or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
 - d. Thermo wells shall be constructed of 316 stainless steel.
- 4. Outside Air Sensors

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
 - b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
 - c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
- 5. Duct Mount Sensors
 - a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
 - b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
 - c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
- 6. Averaging Sensors
 - a. For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
 - b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
 - c. Capillary supports at the sides of the duct shall be provided to support the sensing string.
- C. Humidity Sensors
 - 1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
 - 2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
 - 3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
 - 4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
 - 5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
 - 6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
- D. Carbon Dioxide Sensors
 - 1. Duct Mounted
 - a. Sensor shall be remote-mounted diffusion-aspirated, single-beam dual-wavelength sensor type with Infrared (IR) source, sample cell, tunable-interference filter, and IR detector. .
 - b. Sensing cell shall be provided with thirty (30) inch cable for duct mounting.
 - c. Sensor shall produce linear analog 0-1 Volt DC, 4-20 MA, and binary adjustable switch point form C outputs.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Range shall be 0-2000 parts per million with accuracy of two (2) percent.
 - e. Sensor shall be mounted in weather tight enclosure with forty-one (41) degree Fahrenheit to 104 degree Fahrenheit operating temperature.
 - f. Sensor shall be capable of maintaining calibration within 2% for a one year period of operation.
2. Wall Mounted
- a. Sensor shall be wall-mounted diffusion-aspirated, single-beam dual-wavelength sensor type with Infrared (IR) source, sample cell, tunable-interference filter, and IR detector. .
 - b. Sensing cell shall be provided with thirty (30) inch cable for duct mounting.
 - c. Sensor shall produce linear analog 0-1 Volt DC, 4-20 MA, and binary adjustable switch point form C outputs.
 - d. Range shall be 0-2000 parts per million with accuracy of two (2) percent.
 - e. Sensor shall be mounted in weather tight enclosure with forty-one (41) degree Fahrenheit to 104 degree Fahrenheit operating temperature.
 - f. Sensor shall be capable of maintaining calibration within 2% for a one year period of operation.
- E. Differential Pressure Transmitters
1. General Air and Water Pressure Transmitter Requirements:
- a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
 - c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
 - d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
2. Low Differential Water Pressure Applications (0" - 20" w.c.)
- a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - c. .01-20" w.c. input differential pressure range.
 - d. 4-20 mA output.
 - e. Maintain accuracy up to 20 to 1 ratio turndown.
 - f. Reference Accuracy: +0.2% of full span.
3. Medium to High Differential Water Pressure Applications (Over 21" w.c.)
- a. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:
 - 1) Differential pressure range 10" w.c. to 300 PSI.
 - 2) Reference Accuracy: +1% of full span (includes non-linearity, hysteresis, and repeatability).
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The

transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.

4. Building Differential Air Pressure Applications (-1" to +1" w.c.)
 - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - 1) -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
 - 2) 4-20 mA output.
 - 3) Maintain accuracy up to 20 to 1 ratio turndown.
 - 4) Reference Accuracy: +0.2% of full span.
 5. Low Differential Air Pressure Applications (0" to 5" w.c.)
 - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - 1) (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges. (Select range appropriate for system application.)
 - 2) 4-20 mA output.
 - 3) Maintain accuracy up to 20 to 1 ratio turndown.
 - 4) Reference Accuracy: +0.2% of full span.
 6. Medium Differential Air Pressure Applications (5" to 21" w.c.)
 - a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
 - 1) Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
 - 2) Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.
 - 3) Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
- F. Air Flow Monitoring - Fan Inlet Airflow Measuring Station (AFMS)
1. Subject to compliance with all requirements of this section, provide EBTRON, Inc. Model GTx108-F (basis of design) or approved equal.
 2. Airflow measurement devices shall use the principle of thermal dispersion and provide one self-heated bead-in-glass thermistor and one zero power bead-in-glass thermistor at each sensing node.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Thermal dispersion devices that indirectly heat a thermistor are not acceptable.
- b. Vortex shedding airflow measurement devices, pitot tubes, pitot arrays, piezo-rings and other differential pressure measurement devices are not acceptable.
- 3. General
 - a. Provide one AMD for each measurement location provided on the plans, schedules and/or control diagrams to determine the average airflow rate and temperature of each fan at each measurement location.
 - b. Each AMD shall be provided with a microprocessor-based transmitter and one or more sensor probes.
 - 1) Devices that have electronic signal processing components on or in the sensor probe are not acceptable.
 - c. Airflow measurement shall be field configurable to determine the average actual or standard mass airflow rate.
 - 1) Actual airflow rate calculations shall have the capability of being field adjusted by the transmitter for altitudes other than sea level.
 - d. Temperature output shall be field configurable to provide either the velocity-weighted duct average temperature or simple arithmetic average temperature.
- 4. Sensor Probes
 - a. Each sensor probe shall consist of one sensor node mounted on a 304 stainless steel block with two adjustable zinc plated steel rods connected to 304 stainless steel pivoting mounting feet.
 - b. Sensor node internal wiring connections shall be sealed and protected from the elements and suitable for direct exposure to water.
 - c. Each sensor probe shall be provided with an integral, FEP jacket, plenum rated CMP/CL2P, UL/cUL Listed cable rated for exposures from -67°F to 392°F and continuous and direct UV exposure.
 - 1) Plenum rated PVC jacket cables are not acceptable.
 - d. Each sensor probe cable shall be provided with a connector plug with gold plated pins for connection to the transmitter.
 - e. Sensor node airflow and temperature calibration data shall be stored in a serial memory chip in the cable connecting plug and not require matching or adjustments to the transmitter.
 - f. Each sensor node shall be provided with two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy.
 - 1) Devices that use epoxy or glass encapsulated chip thermistors are not acceptable.
 - g. Each thermistor shall be individually calibrated at a minimum of 3 temperatures to NIST-traceable temperature standards.
 - h. Each sensor node shall be individually calibrated to NIST-traceable airflow standards at a minimum of 16 calibration points.
 - i. The number of independent sensor nodes provided shall be as follows:
 - 1) SWSI and DWDI fans: 2 probes x 1 sensor node/per probe in each fan inlet
 - 2) Fan Arrays (2 to 4 fans):
 - a) 2 probes x 1 sensor node per probe in each fan inlet
 - 3) Fan Arrays (5 to 8 fans): 1 probe x 1 sensor node per probe in each fan inlet.
- 5. Transmitter

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. A remotely located microprocessor-based transmitter shall be provided for each measurement location.
 - b. The transmitter shall be comprised of a main circuit board and interchangeable interface card.
 - c. All printed circuit board interconnects, edge fingers, and test points shall be gold plated.
 - d. All printed circuit boards shall be electroless nickel immersion gold (ENIG) plated.
 - e. All receptacle plug pins shall be gold plated.
 - f. The transmitter shall be capable of determining the average airflow rate and temperature of each fan.
 - 1) Separate integration buffers shall be provided for display airflow output, airflow signal output (analog and network) and individual sensor output (IR-interface).
 - g. The transmitter shall have startup firmware to facilitate setup of multiple fans and fan areas.
 - h. The transmitter shall be capable of providing a high and/or low airflow alarm.
 - i. The transmitter shall be capable of providing individual fan alarming on fan array configurations.
 - j. The transmitter shall be capable of identifying an AMD malfunction via the system status alarm and ignore any sensor node that is in a fault condition.
 - k. The transmitter shall be provided with a 16-character, alpha-numeric, LCD display.
 - 1) The total airflow rate, temperature, airflow alarm, individual fan alarm and system status alarm shall be visible on the display.
 - l. The transmitter shall be provided with two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated and over-current protected analog output signals and either:
 - 1) one isolated RS-485 (field selectable BACnet MS/TP or Modbus RTU) network connection; or
 - 2) one isolated Ethernet (simultaneously supported BACnet Ethernet or BACnet IP, Modbus TCP and TCP/IP) network connection. Note: LonWorks capable models shall be provided without analog outputs.
 - m. Analog signal capability shall include two output terminals: the first, shall provide the total airflow rate; while the second output shall be field configurable to provide one of the following:
 - 1) temperature
 - 2) airflow alarm
 - 3) individual fan alarm; or
 - 4) system status alarm
 - n. Network communications shall provide: the total airflow rate, average temperature, individual fan airflow rates, individual fan temperatures, airflow alarm, individual fan alarm, system status alarm, individual sensor node airflow rates, individual sensor node temperatures and fan inlet area.
 - o. The transmitter shall be powered by 24 VAC and use a switching power supply that is over-current and over-voltage protected.
 - p. The transmitter shall use a "watchdog" timer circuit to ensure continuous operation in the event of brown-out and/or power failure.
6. Performance

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Each sensing node shall have an airflow accuracy of $\pm 2\%$ of reading over an operating range of 0 to 10,000 FPM.
 - 1) Accuracy shall include the combined uncertainty of the sensor nodes and transmitter.
 - a) Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with this requirement over the entire operating range.
 - b. Each sensing node shall have a temperature accuracy of $\pm 0.15^\circ \text{ F}$ over an operating range of -20° F to 160° F .
- 7. Install in accordance with manufacturer's placement and installation guidelines.

G. Air Flow Monitoring Station – Duct Mounted

- 1. Subject to compliance with all requirements of this section, provide Ebtron, Inc. Advantage IV GTx116e-P+ (basis of design) or approved equal.
- 2. Airflow measurement devices shall use the principle of thermal dispersion and provide one self-heated bead-in-glass thermistor and one zero power bead-in-glass thermistor at each sensing node.
 - a. Thermal dispersion devices that indirectly heat a thermistor are not acceptable.
- 3. General
 - a. Provide one Air Flow Measuring Station (AFMS) for each measurement location provided on the plans, schedules and/or control diagrams to determine the average outdoor airflow rate at each duct measurement location.
 - b. Each AFMS shall be provided with a microprocessor-based transmitter and one or more sensor probes.
 - 1) Devices that have electronic signal processing components on or in the sensor probe are not acceptable.
 - c. Airflow measurement shall provide independent, arithmetic average.
 - d. Temperature output shall provide the independent, velocity-weighted duct average temperature.
- 4. Individual Sensing Nodes
 - a. Sensing Node Sensors
 - 1) Self-heated sensor: Precision, hermetically sealed, bead-in-glass
 - 2) thermistor probe
 - 3) Temperature sensor: Precision, hermetically sealed, bead-in-glass
 - 4) thermistor probe
 - b. Sensing Node Housing
 - 1) Material: Glass-filled Polypropylene (Kynar® with /SS option)
 - 2) Sensor Potting Materials: Waterproof marine epoxy
 - c. Sensing Node Internal Wiring
 - 1) Type: Kynar® coated copper
 - d. Airflow Measurement

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 1) Accuracy: $\pm 2\%$ of reading to NIST-traceable airflow standards (includes transmitter uncertainty)
 - 2) Calibrated Range: 0 to 5,000 fpm
 - 3) Calibration Points: 16
 - e. Temperature Measurement
 - 1) Accuracy: $\pm 0.15^\circ\text{F}$ to NIST-traceable temperature standards (includes transmitter uncertainty)
 - 2) Calibrated Range: -20 to 160°F
 - 3) Calibration Points: 3
5. Sensor Probe Assembly
 - a. Tube
 - 1) Material: Gold anodized 6063 aluminum
 - b. Mounting Brackets
 - 1) Material: 304 stainless steel
 - c. Mounting Options & Size Limits
 - 1) Insertion: 6 to 191 in.
 - 2) Stand-off: 6 to 190 in.
 - 3) Internal: 8 to 194 in.
 - d. Probe to Transmitter Cables
 - 1) Type: FEP jacket, plenum rated CMP/CL2P, UL/cUL listed, -67 to 302°F , UV tolerant
 - 2) Connecting Plug: 13/16" nominal diameter with gold plated connector pins
6. Transmitter
 - a. Power Requirement: 24 VAC (22.8 to 26.4 under load) @20V-A max.
 - b. Connector Receptacle Pins and PCB Connections: Gold-plated receptacle pins, PCB interconnects, PCB edge fingers, and test points
 - c. User Interface: 2 line x16-character backlit LCD display and 4 button interface
 - d. BAS Connectivity
 - 1) Transmitter: Three field selectable (0-5/0-10 VDC or 4-20mA), scalable and isolated analog output signals (AO1=airflow, AO2=temperature or alarm, AO3=Not Used).
 - 2) One additional isolated Ethernet (BACnet Ethernet/IP) network connection - Individual sensor node airflow rates and temperatures are available via the network.
 - e. Airflow Alarm
 - 1) Type: Low and/or high user defined setpoint alarm
 - 2) Tolerance: User defined % of setpoint
 - 3) Delay: User defined
 - 4) Zero Disable: Alarm can be disabled when the airflow rate falls below the low limit cutoff value (unoccupied periods)
 - 5) Reset Method: Manual or automatic
 - 6) Visual Indication: LCD display

- 7) Analog Signal Indication: On AO2 assignment
 - f. System Status Alarm
 - 1) Type: Sensor diagnostic system trouble indication
 - 2) Visual Indication: LCD display
 - 3) Analog Signal Indication: On AO2 assignment
 - 7. Install in accordance with manufacturer's placement and installation guidelines.
- H. Air Flow Monitoring – Combination Outdoor Airflow Measuring and Control Damper
- 1. Basis-of-Design Product: Provide TAMCO/EBTRON AIR-IQ or comparable product by one of the following.
 - a. TAMCO/EBTRON
 - b. Greenheck
 - c. Ruskin
 - 2. Type: Factory assembled, damper mounted electronic thermal dispersion airflow and temperature measurement device.
 - 3. Mounting: The suitable for horizontal or vertical airflow applications, as required.
 - 4. Performance:
 - a. Leakage: Class 1A.
 - b. Operating Temperature Limits: -20°F to 160°F.
 - c. Temperature Accuracy: $\pm 0.14^{\circ}\text{F}$ over the entire operating temperature range.
 - d. Airflow Accuracy: $\pm 2\%$ of reading.
 - e. Airflow Rates: 0 to 5,000 FPM.
 - 5. Damper and Sleeve:
 - a. Frame: Galvanized steel 5" x 1" structural hat channel, minimum 16 gauge.
 - b. Blades: Heavy gauge extruded aluminum, airfoil shape.
 - c. Blade Orientation: Horizontal.
 - d. Blade Operation: Opposed blade or parallel.
 - e. Seals:
 - 1) Blade Edge: Silicon or extruded EPDM, mechanically fastened to each blade.
 - 2) Frame: Extruded silicon.
 - f. Linkage: Concealed in frame out of the airstream, plated steel material.
 - g. Axles: Minimum $\frac{1}{2}$ inch dia. stainless steel or aluminum. Removable control shaft shall extend 6" beyond the damper frame.
 - h. Bearings: 304 stainless steel or celcon acetal copolymer.
 - i. Sleeve: 18-inch, minimum 20-gauge sleeve with air straightener.
 - 6. Airflow/Temperature Measurement Devices
 - a. Probes: Each sensor probe shall consist of one to eight independent sensor nodes in a gold anodized, aluminum 6063 alloy tube with 304 stainless steel mounting brackets.
 - b. Sensor Node: Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Chip thermistors of any type or packaging are not acceptable.
 - c. Sensor Density Requirements: Number of individual sensor nodes provided for each damper location shall be detailed in published documentation by the manufacturer.

- d. Wiring: All internal wiring between thermistors and probe connecting cables shall be Kynar jacketed.
 - 1) Manufacturer shall provide UL listed, FEP jacketed, plenum rated cable(s) between sensor probes and the remote transmitter.
- 7. Transmitter:
 - a. Supplied by the same manufacturer as the measuring station.
 - b. Input power shall be 24VAC/24VDC. Include over-voltage and over-current protection, and ensure continuous operation following power failures and/or brown-outs.
 - c. Analog output shall be field configurable as linear 0-5 VDC, 0-10 VDC or 4-20mA signals.
 - d. Two isolated and fused analog output signals and one RS-485 network connection
 - 1) One analog output signal shall provide the average airflow rate.
 - 2) One analog output signal shall be field configurable to output the average temperature, the velocity weighted temperature or a binary airflow alarm.
 - 3) The RS-485 network connection shall be field configurable as BACnet MS/TP.
 - e. The RS-485 connection shall transmitt the average airflow rate, average temperature, individual airflow rates of each sensor node, and individual temperatures of each sensor node and system status.
 - f. High visibility backlit LCD for display of either the averaged or individual sensor airflow and temperature measurements, in user selectable units of measure.
- I. Air Flow Monitoring – Outdoor Air Hood
 - 1. Provide airflow temperature measurement device for installation in the outdoor air hood (with adjustable standoff) of rooftop packaged air handling unit. Provide where indicated on the drawings, upstream of the outdoor damper.
 - 2. Each measuring device shall consist of one or more multi-point measuring probes and a single microprocessor-based transmitter. Each transmitter shall operate on 24VAC.
 - 3. Each sensing point shall independently determine the airflow rate and temperature, which shall be equally weighted and averaged by the transmitter prior to output.
 - 4. General
 - a. Probe and Sensor Node Configurations
 - 1) 1 probe x 1 sensor node
 - 2) 2 probes x 1 sensor node/probe
 - b. Installed Airflow Accuracy
 - 1) In Openings Less or Equal to 8 sq.ft.: $\pm(3\% \text{ to } 15\%)$, typical.
 - 2) In Openings Greater Than 8 sq.ft.: Not recommended.
 - c. Sensor Node Averaging Method
 - 1) Airflow: Independent (arithmetic average on 2 sensor configurations installed at a single measurement location).
 - 2) Temperature: Independent, velocity weighted average on 2 sensor configurations installed at a single measurement location.
 - d. Listings and Compliance
 - 1) UL: 60730-1, 60730-2-9; CAN E60730-1, E60730-2-9 (EF-A2000-U Only).

- 2) FCC: This device complies with Part 15 of the FCC rules.
 - 3) RoHS: This device is RoHS2 compliant.
 - e. Environmental Limits
 - 1) Temperature:
 - a) Probes 0 to 2,000 fpm: -20 to 160 °F.
 - b) Probes 0 to 3,000 fpm: 0 to 160 °F .
 - c) Transmitter: -20 to 120 °F.
 - 2) Humidity: (non-condensing).
 - a) Probes: 0 to 100%.
 - b) Transmitter: 5 to 95%.
- 5. Individual Sensing Nodes
 - a. Sensing Node Sensors
 - 1) Self-heated sensor: Precision, hermetically sealed, bead-in-glass thermistor probe.
 - 2) Temperature sensor: Precision, hermetically sealed, bead-in-glass thermistor probe.
 - b. Sensing Node Housing
 - 1) Material: Glass-filled Polypropylene.
 - 2) Sensor Potting Materials: Waterproof marine epoxy.
 - c. Sensing Node Internal Wiring
 - 1) Type: Kynar® coated copper.
 - d. Airflow Measurement
 - 1) Accuracy: $\pm 3\%$ of reading (typical), 4% max. to NIST-traceable airflow standards (includes transmitter uncertainty).
 - 2) Calibrated Range: 0 to 3,000 fpm.
 - 3) Calibration Points: 7.
 - e. Temperature Measurement
 - 1) Accuracy: ± 0.15 °F to NIST-traceable temperature standards (includes transmitter uncertainty).
- 6. Sensor Probe Assembly
 - a. Tube
 - 1) Material: Mill finish 6063 aluminum.
 - b. Mounting Brackets
 - 1) Material: 304 stainless steel.
 - c. Mounting Type & Overall Probe Length
 - 1) Insertion: 6, 8 or 16 in. (adjustable).
 - 2) Stand-off: 6, 8 or 16 in. (adjustable).
 - d. Probe to Transmitter Cables
 - 1) Type: FEP jacket, plenum rated CMP/CL2P, UL/cUL listed, -67 to 302 °F, UV tolerant.
 - 2) Standard Lengths: 10, 25 and 50 ft.
 - 3) Connecting Plug: 0.60" nominal diameter.
- 7. Transmitter
 - a. Power Requirement: 24 VAC (22.8 to 26.4 under load) @8V-A.
 - b. User Interface: 16-character LCD display and 4 button interface.
 - c. BAS Connectivity:
 - 1) EF-N2000 Transmitter: One field selectable (BACnet MS/TP or Modbus RTU) and non-isolated RS-485 network connection. Individual sensor node airflow rates and temperatures shall be available via the network (provide individual 24 VAC transformers for

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

each EF-N2000 transmitter for applications requiring isolated RS-485).

- d. Relay
 - 1) Type: Dry Contact w/ onboard jumper to drive a remote LED (R1=alarm).
 - 2) Status: N.O. or N.C. via user setup configuration.
 - 3) Rating: 30 VDC or 24 VAC @ 3 amp. max.
- e. Airflow Alarm
 - 1) Type: Low and/or high user defined setpoint alarm.
 - 2) Tolerance: User defined % of setpoint.
 - 3) Delay: User defined.
 - 4) Zero Disable: Alarm can be disabled when the airflow rate falls below the low limit cutoff value (unoccupied periods).
 - 5) Reset Method: Manual or automatic.
 - 6) Visual Indication: Yes, LCD display.
 - 7) Network Indication: Yes (EF-N2000 only).
 - 8) Analog Signal Indication: Yes, on AO2 assignment (EF-A2000 only).
 - 9) Contact Closure Relay: Yes, on R1 assignment.
- f. System Status Alarm
 - 1) Type: Sensor diagnostic system trouble indication.
 - 2) Visual Indication: Yes, LCD display.
 - 3) Network Indication: Yes (EF-N2000 only).
 - 4) Analog Signal Indication: Yes, on AO2 assignment (EF-A2000 only).
 - 5) Contact Closure Relay: Yes, on R1 assignment.
- 8. Install in accordance with manufacturer's placement and installation guidelines.
- 9. Basis of Design: Ebtron EB-Flow II EF-x2000-U

J. Water Flow Meters

- 1. Insertion Turbine Flowmeters:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide ONICON Model F-1100 or comparable product by one of the following:
 - 1) ABB
 - 2) Dynasonics
 - 3) EMCO Flow Systems
 - 4) ERDCO Engineering Corp
 - 5) Hoffer Flow Controls, Inc
 - 6) ONICON Incorporated
 - b. Description: Flowmeter with sensor and indicator.
 - c. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - d. Sensor: Impeller turbine; for inserting in pipe fitting or for installing in piping and measuring flow directly in gallons per minute.
 - 1) Design: Device or pipe fitting with inline turbine and integral direct-reading scale for water.
 - 2) Construction: Electroless nickel plated brass or stainless-steel body, with plastic turbine or impeller.
 - 3) Electronics Enclosure: Weathertight aluminum enclosure
 - 4) Minimum Pressure Rating: 200 psig.
 - 5) Minimum Temperature Rating: 180 deg F.
 - e. Accuracy: Plus or minus 1 percent.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- f. Pressure Drop: Less than 1 PSI at 20 ft/s in 1½" pipe, decreasing in larger pipes and lower velocities.
 - g. Display: Shows rate of flow, with register to indicate total volume in gallons.
 - h. Output Signals Provided: Frequency Output 0 – 15 V peak pulse.
 - i. Operating Instructions: Include complete instructions with each flowmeter.
- 2. Insertion Electromagnetic:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide ONICON F-3500 or comparable product by one of the following:
 - 1) ABB
 - 2) Dynasonics
 - 3) EMCO Flow Systems
 - 4) Emerson Process Management Rosemount Inc.
 - 5) ERDCO Engineering Corp
 - 6) Hoffer Flow Controls, Inc
 - 7) ONICON Incorporated
 - b. Description: Insertion electromagnetic flowmeter with sensor and indicator.
 - c. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - d. Accuracy:
 - 1) ± 1.0% of reading from 2 to 20 ft/sec
 - 2) ± 0.02 ft/sec below 2 ft/sec
 - e. Flow Range: 0.1 ft/s to 20 ft/s (200:1 turndown)
 - f. Sensing Method: Electromagnetic sensing (no moving parts)
 - g. Pressure Drop: Less than 0.1 psi at 12 ft/s velocity in 3" and larger pipes
 - h. Material:
 - 1) Wetted metal components: 316 stainless steel
 - 2) Sensor head: Polystyrene
 - i. Electronics Enclosure: Weathertight NEMA 4 aluminum enclosure
 - j. Integral microprocessor-based electronics. Provide output signal to BAS.
 - k. Operating Instructions: Include complete instructions with each flowmeter.
- K. Thermal Energy (BTU) Meters
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ONICON System-10 or comparable product by one of the following:
 - a. Hoffer Flow Controls, Inc
 - b. ONICON Incorporated
 - c. Veris Industries
 - 2. Description: System with flow meter, temperature sensors, transmitter, indicator, and connecting wiring.
 - 3. Temperature Sensors: Insertion-type transducer.
 - 4. Accuracy: ± 0.15° F.
 - 5. Display: Alphanumeric LCD, visually displays:
 - a. Total Energy: Btu, kW-hrs or ton-hrs
 - b. Energy Rate: Btu/hr, kW or tons
 - c. Total Flow: Gallons
 - d. Flow Rate: Gpm, gph, mgd,
 - e. Supply Temperature: °F
 - f. Return Temperature: °F
 - 6. Memory: Non-volatile EEPROM. Retains all program parameters and totalized values in the event of power loss.
 - 7. Enclosure: Steel NEMA 13, wall mount.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

8. Input Power: 24 VAC, 60 Hz, 500 mA.
9. Network Interface: Coordinate with building automation system.
10. Network Interface: N2 - (Includes Johnson Controls - N2 serial interface)
11. Operating Instructions: Include complete instructions with each thermal-energy meter system.

L. Steam Flow Meters

1. In-Line Dual Differential Pressure With Remote Meter Display
 - a. Basis-of-Design Product: Provide Armstrong Veris Acclelabar Model AFS with remote mount Foxboro IMV30 Multivariable Transmitter.
 - b. Steam flow meters shall utilize a dual D/P technology.
 - c. Configuration:
 - 1) Toroidal nozzle design and a sensing element.
 - 2) Meter body shall have an integral port for an optional RTD.
 - 3) A metal tag (SST) shall be permanently attached to the flow sensor showing Model No., Serial No., Pipe I.D., Tag No., Max Pressure & Temperature, Max D/P, Max Allowable Insertion D/P and Flow Coefficient.
 - d. Material:
 - 1) Flow Element: 316SST Stainless Steel
 - 2) Meter Body: 316 Stainless Steel
 - 3) Electronics Enclosure: Epoxy painted aluminum
 - 4) Measuring station shall be rated up to 600#
 - e. Accuracy:
 - 1) +/- 0.50% of actual flow rate over a maximum flow turndown of up to 65:1.
 - 2) Installation of the meter shall require no straight run regardless of the upstream piping configuration.
 - 3) Certified test data from independent flow laboratories shall be provided as verification.
 - 4) Repeatability: +/- 0.075% of actual value over the entire flow range.
 - f. Quality: The sensor shall be designed and manufactured under the control of an ISO 9001 program.
 - g. Meters shall have a microprocessor to display totalizer flow, flow rate, temperature, pressure, time, and date; alarms for high and low flow rate and temperature.
 - 1) Computer shall have 4- to 20-mA or 2- to 10-V output for temperature, pressure, and contact closure for flow increments.
 - 2) Independent timers to store four peak flow rates and total flow.
 - 3) Interface compatible with Building Automation and Temperature Control System.
 - 4) Microprocessor Enclosure: NEMA 250, Type 4.
 - h. Electronics Enclosure: Weathertight NEMA 4x aluminum enclosure
 - i. Connections: Flanged.
 - j. Include Resistance Temperature Detector (RTD).
 - k. Provide flow straightener upstream of flow meter.
 - l. Integral microprocessor-based electronics. Provide output signal to BAS.
2. Inline Vortex With Meter Display
 - a. Basis-of-Design Product: Provide Onicon F-2600 flow meter with Onicon D-100 remote mount display module.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Steam flow meters shall be a vortex mass flow type complete with integral density compensation to provide direct mass steam flow output.
- c. Meter shall calculate mass flow corrected for density with real time calculations based on temperature measured by an integral 1,000 ohm platinum RTD.
 - 1) Mass flow inferred from specified steam pressure or calculated externally to the flow meter will not be acceptable.
- d. The flow meter shall be sized by the manufacturer for each specific application and installed according to manufacturer's recommendations.
- e. Accuracy: $\pm 1.5\%$ of actual reading over the range of the meter, including all errors associated with velocity measurement, temperature and/or pressure measurement, and density compensation.
- f. Calibration:
 - 1) Multipoint point calibration against the manufacturer's N.I.S.T. traceable flow standards.
 - 2) The manufacturer shall provide a certificate of calibration for each meter.
 - 3) Meter shall be programmed by the manufacturer for each specific application and shall be ready to use upon delivery.
- g. Material:
 - 1) Flow meter body shall be constructed of 316L stainless steel.
 - 2) Weather-tight NEMA-4X aluminum electronics enclosure.
 - 3) Maximum operating temperature shall be 5000 F.
 - 4) Meter shall be provided with ANSI class 150 or class 300 flanges as required to meet system requirements.
- h. Output:
 - 1) Meter shall provide a loop-powered 4-20 mA output signal calibrated in direct mass flow rate units for connection to the BAS.
 - 2) Integral pulse output for steam mass flow totalization shall be provided.
 - 3) All outputs shall be linear with mass flow rate.
 - 4) Meter shall display steam mass flow rate and mass flow total with an integral LCD display and support field programming of all parameters.
- i. Installation:
 - 1) Provide a flow straightener, if required to meet the manufacturer's minimum upstream straight pipe run requirement.
 - 2) Provide lateral and horizontal supports as required to minimize vibration at the meter location.
 - 3) Meter shall also have integral diagnostics to verify installation conditions and the proper operation of the meter.
- j. Provide an ONICON D-100 totalizing flow meter display with a serial communications interface to provide local indication of steam flow rate and total data with network interface to communicate flow data to the building control network..
 - 1) Accuracy
 - a) Analog inputs: 0.1% of full scale
 - b) Analog outputs: 0.1% of full scale
 - 2) Electronics Enclosure:
 - a) Steel NEMA 4 wall mount 10" x 8" x 4"
 - 3) Input power:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a) 24 VAC 50/60 Hz, 500 mA max
- 4) Display
 - a) 2-line Alphanumeric LCD displays flow rate and flow total
- 5) Programming
 - a) Factory programmed for specific application
 - b) Field programmable via front panel interface
- 6) Memory
 - a) Non-volatile EEPROM memory retains all program parameters and totaled values in the event of power loss.
- 7) Input Signals
 - a) One (1) totalizing flow input 4-20 mA, contact closure or pulse
 - b) One (1) contact closure input for flow direction
- 8) Output Signals
 - a) Two (2) isolated contact closure outputs for separately totalizing forward and reverse flow from the standard input
 - b) Isolated contact closure output for indicating flow direction
 - c) Contact rating: 100 mA, 50 V
 - d) Contact duration: 0.5, 1, 2, or 6 sec
- 9) The network interface shall transmit via a serial interface conforming to one of the following protocols: BACnet MS/TP, BACnet IP, LONWORKS, MODBUS RTU RS485, MODBUS TCP/IP, JCI-N2 or Siemens P1.

M. Natural Gas Meters

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide ONICON F-5000 or comparable product by one of the following:
 - a. Comate Intelligent Sensor Co., Ltd
 - b. ONICON Incorporated
 - c. Sage Metering
- 2. Description: Thermal mass flow meter, complete with all installation hardware necessary to enable insertion and removal of the meter without system shutdown.
- 3. Calibration:
 - a. Individually wet-calibrated against a standard that is directly traceable to NIST.
 - b. Meter shall allow for field validation testing of the current calibration and provide for a printed validation test report.
 - c. A certificate of calibration shall be provided with each flow meter.
- 4. Flow meter shall be hand-insertable up to 60 psi.
- 5. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
- 6. Sensing: Pair of encapsulated platinum sensors. Meter shall not require additional temperature or pressure compensation.
- 7. Accuracy:
 - a. $\pm 1\%$ of rate from 500-7000 SFPM.
 - b. $\pm 2\%$ of rate from 100-500 SFPM.
- 8. Flow Range: 1000:1 turndown
- 9. Material:
 - a. Wetted metal components: 316 stainless steel.
- 10. Electronics Enclosure: Weathertight NEMA 4 aluminum enclosure
- 11. Integral microprocessor-based electronics. Provide output signal to BAS.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

12. Output:
 - a. (1) analog 4-20mA output
 - b. (1) additional output factory configured as either a totalizing pulse or an RS485 interface for connection to a BACnet MS/TP or Modbus RTU serial network.
13. Display: Provide a D-100 Series Display Module for local or remote indication of flow rate and total.
14. Output signals: Shall be either serial network (protocol conforming to BACnet® MS/TP, BACnet/IP, LONWORKS®, MODBUS RTU RS485, MODBUS RTU TCP/IP, JCI-N2, or Siemens-P1) or via individual analog and pulse outputs.
15. Operating Instructions: Include complete instructions with each flowmeter.
16. Provide a flow conditioner if required to meet the manufacturer's minimum upstream straight pipe run requirement.
17. Each flow meter shall be covered by the manufacturer's two-year warranty.

N. Power Monitoring Devices

1. Current Measurement (Amps)
 - a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.
 - b. Current Transformer – A split core current transformer shall be provided to monitor motor amps.
 - 1) Operating frequency – 50 - 400 Hz.
 - 2) Insulation – 0.6 Kv class 10Kv BIL.
 - 3) UL recognized.
 - 4) Five amp secondary.
 - 5) Select current ration as appropriate for application.
2. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
 - a. 6X input over amp rating for AC inrushes of up to 120 amps.
 - b. Manufactured to UL 1244.
 - c. Accuracy: +.5%, Ripple +1%.
 - d. Minimum load resistance 30kOhm.
 - e. Input 0-20 Amps.
 - f. Output 4-20 mA.
 - g. Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).

O. Power and Energy Meters:

1. Power meters shall be furnished by BAS contractor, installed and wired by the electrical contractor. Communication trunk from the BAS and integration with the BAS shall be provided by the BAS contractor. Power meter(s) shall be compatible with the Building Automation System (BAS) provided under Division 23. Refer to Electrical
2. The power meter shall be fully electronic with multi-line backlit LCD display showing measured parameters as well as alarm functions and pulse output.
3. The power meter shall perform the following measurements:
 - a. Accumulated Real Energy (kWh) for each phase and total of all phases

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Accumulated Reactive Energy (kVARh) and Apparent Energy (kVAh) totals for all phases
 - c. Net Present Demand for Real (kW), Reactive (kVAR) and Apparent (kVA) Power over a user-specified interval (block or sliding window)
 - d. Maximum (Peak) Real (kW), Reactive (kVAR) and Apparent (kVA) Demand Intervals
 - e. Instantaneous Real (kW), Reactive (kVAR) and Apparent Power (kVA), by phase and in total
 - f. Current (amps) for each phase and average of all phases
 - g. Phase-to-phase voltage for each phase and average of all phase pairs
 - h. Phase-to-neutral voltage for each phase pair and average of all phases
 - i. Power factor for each phase and average of all phases
 - j. AC frequency
- 4. The power meter shall communicate using the BACnet MS/TP protocol at speeds from 9600 to 115,200 baud (no parity). The meter shall provide a BACnet Device object, a set of writable Analog Value objects for remote configuration, a set of Analog Input objects to provide access to scaled 32-bit measurement values and their unit types, and a set of Binary Input objects for indicating individual alarm conditions.
 - 5. The meter shall be UL/CUL listed to the latest applicable safety standards.
 - 6. Power meter models shall accept voltage input over the range of 90 to 600 VAC (50 or 60 Hz).
 - 7. The power meter shall accept 0 to 0.333VAC input from up to three current transducers (U018 Rope Style CTs only) from 20 to 5000 amps.
 - 8. The measured energy consumption shall be retained in non-volatile memory for the life of the product warranty.
 - 9. The power meter shall have demand measurement programmable for up to 6 sub-intervals of 10 seconds to 546 minutes duration.
 - 10. Meter shall be optionally available in an outdoor NEMA 4X enclosure.
 - 11. The power meter shall operate from -30°C to +70°C.
 - 12. The power meter shall have dimensions not exceeding 4.2" x 3.6" x 2.3".
 - 13. The power meter shall meet both ANSI C12.20 .5% and IEC 62053-22 Class .5S real power and energy accuracy specifications.
 - 14. The power meter shall meet IEC 62053-22 Class 2 reactive power and energy accuracy specifications.
 - 15. The power meter shall be configurable for operation on Single Phase (AN or AB), Split Phase (ABN), Delta (ABC), and Wye (ABCN) systems.
 - 16. The power meter shall have automatic phase reversal compensation such that it is insensitive to the CT's load orientation.
 - 17. The power meter shall have separate control power inputs such that it may be powered from a different service than it measures.
 - 18. The power meter shall have Phase Loss Alarm contacts with a user configurable phase loss threshold.
 - 19. The power meter shall have a user-configurable Pulse Contact input to support measurement of other related energy (Gas, Water, Steam, etc.) via BACnet using a simple pulse-output transducer.
 - 20. The power meter shall be configurable for use with Potential Transformers to 5000 volts.
 - 21. The power meter shall support warnings for low power factor (phase current or voltage miss-wired), current over range, voltage over range, and frequency out of range.

22. The product shall have a 5-year warranty.
23. The power meter shall be Veris E50H2 or equivalent.

P. Status and Safety Switches

1. General Requirements

- a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BAS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

- a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
- b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
- c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

3. Air Filter Status Switches

- a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
- b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
- c. Provide appropriate scale range and differential adjustment for intended service.

4. Air Flow Switches

- a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.

5. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.

- a. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.

6. Low Temperature Limit Switches

- a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
- b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
- c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.

2.10 OUTPUT DEVICES

A. Actuators

1. General Requirements
 - a. Damper and valve actuators shall be electronic. Controls submittals shall indicate actuator fail position as normally open or closed.
2. Electronic Damper Actuators
 - a. Electronic damper actuators shall be direct shaft mount.
 - b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
 - c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
 - d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
3. Electronic Valve Actuators
 - a. Electronic valve actuators shall be manufactured by the valve manufacturer.
 - b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.
 - c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
 - d. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and

may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

- e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.

B. Control Relays

1. Control Pilot Relays

- a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
- b. Mounting Bases shall be snap-mount.
- c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
- d. Contacts shall be rated for 10 amps at 120VAC.
- e. Relays shall have an integral indicator light and check button.

C. Control Valves (Chilled Water)

- 1. All modulating control valves shall be of the "pressure independent" type configured with one integrated valve body that incorporates one chamber with an adjustable Cv and a separate pressure regulating chamber used to maintain a constant differential pressure across the control surface.
- 2. Each control valve shall be individually flow tested at the factory and verified to deviate no more than $\pm 5\%$ through the selected operating pressure range. A calibrated performance tag shall be provided with each valve that verifies the flow rate in 10° rotation increments up to full rated flow (option with $1/2"$). All testing shall be performed with instruments calibrated to the requirements of ANSI/ISA-S75.11-1985, with traceability to NIST and/or ISO standards.
- 3. Control valve rangeability shall be 50:1 minimum.
- 4. Each control valve shall be subjected to 70 psid and tested to exceed ANSI/FCI 70-2-1998 leakage ratings. Class IV leakage or better is required for control valves 2" nominal size and less. Class III leakage or better is required for control valves larger than 2".
- 5. In all control valves 8" and smaller, it shall be possible to modify the valve flow characteristics without removing the valve from the piping system.
- 6. Balancing valves and associated balancing shall not be required where pressure independent modulating control valves are installed.
- 7. The control valve actuator shall modulate all valves up to 8" in nominal size from 0 to 100% design flow while rotating the valve stem a maximum of 90° .
- 8. There shall be three ports installed at the factory integral to each valve and capable of being used to measure pressure or temperature. The first port shall be installed at the inlet to the valve. The second shall be installed between the Cv chamber and the pressure regulating chamber. The third shall be installed at the outlet of the valve. Should the ports not be provided as part of the valve body than they shall be installed in a spool piece and attached to the body.
- 9. The differential pressure between the first and the third port shall be used in commissioning to verify that the minimum differential pressure (typically 5 psid) required for pressure independent operation is available.

10. The differential pressure between the first and second ports shall be used to verify proper valve operation and flow regulation. It shall be possible to verify the flow rate through the control valve using the valve stem position and the differential pressure measurement between the first and second port in the valve. If these valve features are not available, a flow meter shall be installed to verify actual flow rate in operation through the valve.
11. CB valves to be standard modulating.
12. All valves shall be warranted by the manufacturer for no less than 3 years from the date of purchase.
13. Acceptable manufacturers: Belimo, Brae, Danfoss, Delta Flow.

D. Control Valves (Hot Water & Steam Systems)

1. All automatic control valves shall be "pressure independent" type, fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.
2. Hot water control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving variable flow air handling unit coils shall be sized for a pressure drop equal to the actual coil pressure drop, but no less than 5 PSI. Valves (3-way) serving constant flow air handling unit coils with secondary circuit pumps shall be sized for a pressure drop equal to 25% the actual coil pressure drop, but no less than 2 PSI. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no less than 5 PSI. Valves for terminal reheat coils shall be sized for a 2 PSIG pressure drop, but no more than a 5 PSI drop.
3. Ball valves shall be used for hot and chilled water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units except those described hereinafter.
4. Modulating plug water valves of the single-seat type with equal percentage flow characteristics shall be used for all special applications as indicated on the valve schedule. Valve discs shall be composition type. Valve stems shall be stainless steel.
5. Butterfly valves shall be acceptable for modulating large flow applications greater than modulating plug valves, and for all two-position, open/close applications. In-line and/or three-way butterfly valves shall be heavy-duty pattern with a body rating comparable to the pipe rating, replaceable lining suitable for temperature of system, and a stainless steel vane. Valves for modulating service shall be sized and travel limited to 50 degrees of full open. Valves for isolation service shall be the same as the pipe. Valves in the closed position shall be bubble-tight.
6. All valves shall be warranted by the manufacturer for no less than 3 years from the date of purchase.
7. Acceptable manufacturers: Belimo, Brae, Danfoss, Delta Flow.

2.11 FIREFIGHTERS' SMOKE CONTROL STATION

- A. A Fireman's Smoke Control Station (FSCS) shall be equal to Automation Displays, Inc. and provided for firefighter control and monitoring of the building's smoke control system in compliance with International Building Code and NFPA 92, "Standard for Smoke-Control Systems."
 - 1. The FSCS shall be UL Listed as a Firefighters Smoke Control Station under UL864 - UUKL for smoke control.
- B. The FSCS shall provide individual manual command switches and pilot lamps for each individual piece of operating smoke control equipment involved in the smoke control system on a custom building graphic panel.
 - 1. Panel face arrangement shall be similar to that shown on the building automatic system control schematics, and shall be submitted for review and approval prior to fabrication.
 - 2. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all smoke control equipment, annunciated by fan and zone, and by pilot-lamp-type indicators as follows:
 - a. Fans, dampers and other operating equipment in their normal status – WHITE.
 - b. Fans, dampers and other operating equipment in their off or closed status – RED.
 - c. Fans, dampers and other operating equipment in their on or open status – GREEN.
 - d. Fans, dampers and other operating equipment in a fault status – YELLOW/AMBER.
- C. The FSCP shall communicate and interface to the HVAC control system and central operator's computer through the local area network (LAN).
- D. The FSCP shall include and monitor/control the following, with indicating pilot lights:
 - 1. Area of the building in alarm
 - 2. Fan on-off control (On-Auto-Off)
 - 3. Damper open-close control (Open-Auto-Close)
 - 4. Fan and damper status
- E. The FSCS shall consist of the following assemblies:
 - 1. Steel Enclosure with Hinged Locking Front Panel
 - 2. Graphic Panel with Pilot Lamps and Switches
 - 3. DIN Rail for Installation of PXC Modular Controller
 - 4. Plug-in Cabling
 - 5. Trunk and Input Power Terminals
- F. The fire-fighter's control panel actions shall be as follows:
 - 1. ON-OFF and OPEN-CLOSE control actions shall have the highest priority of any control point within the building.
 - a. Once issued from the fire fighter's control panel, automatic or manual control from any other control point within the building shall not contradict the control action.

- b. Where automatic means are provided to interrupt normal, nonemergency equipment operation or produce a specific result to safeguard the building or equipment including, but not limited to, duct freezestats, duct smoke detectors, high-temperature cutouts, temperature-actuated linkage and similar devices, such means shall be capable of being overridden by the fire fighter's control panel.
 - c. The last control action as indicated by each fire fighter's control panel switch position shall prevail. Control actions shall not require the smoke control system to assume more than one configuration at any one time.
 - 2. Only the AUTO position of each three-position fire-fighter's control panel switch shall allow automatic or manual control action from other control points within the building.
 - a. The AUTO position shall be the NORMAL, nonemergency, building control position.
 - b. Where a fire fighter's control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator.
 - c. Where directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone.
 - d. Control actions shall not require the smoke control system to assume more than one configuration at any one time.
- G. A general HVAC alarm light shall be provided on the panel face. The building automation system shall energize the light for high priority HVAC alarms (as defined by the owner).
- H. A pilot lamp test shall be provided for testing all pilot lamps on the FSCS. The FSCS shall be equipped with an audible annunciator to sound upon specific monitored conditions.
- I. A lockable security cover shall be provided.

2.12 MISCELLANEOUS DEVICES

- A. Local Control Panels
 - 1. All control panels shall be factory constructed, incorporating the BAS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.
 - 2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
 - 3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
 5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
 6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.
- B. Thermostats
1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.
- C. Isolation Room Pressure Monitor
1. Basis-of-Design Product: Subject to compliance with requirements, provide TSI PresSura RPM10 or comparable product by one of the following:
 - a. Dwyer Instruments, Inc
 - b. Setra Systems
 - c. TSI Incorporated
 2. Sensor
 - a. Range: -0.20000 to +0.20000 in H₂O
 - b. Accuracy: $\pm 10\%$ of reading ± 0.00001 in H₂O
 - c. Resolution: 5% of reading
 - d. Temperature Compensation Range: 55 to 95 °F
 3. Alarms
 - a. Low Alarm: -0.19500 to +0.19500 in H₂O
 - b. High Alarm: -0.19500 to +0.19500 in H₂O
 4. Touchscreen Display
 - a. Size 4.3 in. diagonal
 - b. Resolution QVGA
 5. Dimensions:
 - a. 7 in. x 5.875 in. x 1.75 in.
 - b. Protrusion from wall 0.625 in.
 - c. Mounts to triple-gang standard depth electrical box
 6. Inputs
 - a. Exhaust Flow 0-10 VDC
 - b. Remote Keyswitch Open/Closed Signal
 - c. Pressure Transducer 0-10 VDC
 - d. Room Pressure Sensor 0-10 VDC
 - e. Door Switch Open/Closed Signal
 - f. Room Occupancy Open/Closed Signal
 7. Analog Output: (1) Flow or Room Pressure Differential 0-10 VDC or 4-20 mA
 8. Contact Outputs: Low Alarm and High Alarm / Room Mode
 9. Communications Protocols: Compatible with [Agency] Johnson Controls Metasys management system
 10. Input Power: 24 VAC, 60 Hz
- D. Mechanical Room Gas Detection System
1. Basis-of-Design Product: Subject to compliance with requirements, provide gas detection system by Macurco or comparable product by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Setra Systems
2. Addressable Control Panel (Basis of Design: Macurco DVP-120B)
 - a. Voltage/Current: 90 – 250 VAC, 1 Amp, 47 – 63 Hz, single phase.
 - b. Operating Temperature: 32°F to 120°F.
 - c. Ambient Humidity: 0% to 90% RH non-condensing.
 - d. Display: LCD display: 2 rows of 16 characters with backlight.
 - e. Relays: Three 10A, 240 VAC SPDT fan/alarm relays.
 - f. Settings: External keypad for user selection of the transducer/alarm display and setting the configuration.
 - g. Status Indicators: (LED): Power, ALARM/warning, hush, Relay 1, Relay 2 & Relay 3.
 - h. Alarms: Drivers for external Horn and Strobe, externally visible system, alarm and relay status indicators.
 - i. Enclosure: Lockable NEMA 1 type enclosure.
 - j. Certifications: ETL Listed to UL 2017.
 - k. Warranty: Two Year Limited Warranty.
 - l. Accessories: Calibration Kit.
3. Carbon Monoxide Monitor (Basis of Design: Macurco CM-6)
 - a. Voltage/Current:
 - 1) Power: 3 W (max) from 12 to 24 VAC or 12 to 32 VDC
 - 2) Current @ 24 VDC: 75 mA in alarm, 50 mA fan relay on and 23 mA stand by.
 - b. Operating Temperature: -4°F to 120°F.
 - c. Ambient Humidity: 10% to 90% RH non-condensing.
 - d. Housing: Grey or White
 - e. Display: LED.
 - f. Range: 0-200 PPM
 - 1) Low Level Alarm: 50 PPM (Adjustable)
 - 2) High Level Alarm: 200 PPM (Adjustable)
 - 3) Expected Sensor Life: 10 Years
 - g. Current Loop:
 - 1) Analog: 4-20mA
 - 2) MRS-485: Digital Modbus adapter
 - 3) BRS-485: BMS communication
 - h. Mounting: 4" x 4" electrical box, behind the gas-fired equipment
 - 1) Wall mounted, 5 feet above the floor.
 - i. Relays:
 - 1) 5A fan relay & 0.5A alarm relay.
 - 2) User adjustable settings.
 - j. Certifications: ETL Listed.
 - k. Warranty: Two Year Limited Warranty.
 - l. Accessories: Calibration Kit.
4. Combustible Gas Monitor (Basis of Design: Macurco GD-6)
 - a. Voltage/Current:
 - 1) Power: 3 W (max) from 12 to 24 VAC or 12 to 32 VDC
 - 2) Current @ 24 VDC: 75 mA in alarm, 50 mA fan relay on and 23 mA stand by.
 - b. Operating Temperature: -4°F to 120°F.
 - c. Ambient Humidity: 10% to 90% RH non-condensing.
 - d. Housing: Grey or White
 - e. Display: LED.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- f. Range: 0-50% LEL
 - 1) Low Level Alarm: 10% LEL (Adjustable)
 - 2) High Level Alarm: 20% LEL (Adjustable)
 - 3) Expected Sensor Life: 5 Years
 - g. Current Loop:
 - 1) Analog: 4-20mA
 - 2) MRS-485: Digital Modbus adapter
 - 3) BRS-485: BMS communication
 - h. Mounting: 4" x 4" electrical box, behind/above the gas-fired equipment.
 - 1) Propane (LP): Wall mounted, 1 foot above the floor.
 - 2) Methane (NG): Mounted on the ceiling or on the wall within 1 foot of the ceiling.
 - 3) Hydrogen (H2): Mounted on the ceiling or on the wall within 1 foot of the ceiling.
 - i. Relays:
 - 1) 5A fan relay & 0.5A alarm relay.
 - 2) User adjustable settings.
 - j. Certifications: ETL Listed.
 - k. Warranty: Two Year Limited Warranty.
 - l. Accessories: Calibration Kit.
5. Emergency Power Off Button
- a. Voltage/Current: Optional LED Power 12-24 VAC/VDC, 21 mA
 - b. Operating Temperature: 15°F to 120°F.
 - c. Ambient Humidity: 0% to 90% RH non-condensing.
 - d. Mounting: Mount to standard single gang electrical box.
 - e. Relays: Two 2 Form C contacts rated at 10A, ½ HP, 125/250 VAC, 6A, 30V.
 - f. Status Indicators: Optional illumination 12-24 VAC/VDC, 21 mA (red) to be used as a status light, indicating activation.
 - g. Enclosure: Polycarbonate, with cover to block button from accidental bumps.
 - h. Certifications: UL/cUL Listed ADA Compliant.
 - i. Warranty: Three-year guarantee against breakage of polycarbonate in normal use (one year on electro-mechanical and electronic components).
 - j. Accessories: Twistable reset switch.
6. Combination Horn and Strobe
- a. Nominal Voltage: Regulated 24VDC.
 - b. Voltage/Current:
 - 1) Horn and Strobe: 74-133mA.
 - c. Synchronize: Sync Module Option to synchronize strobes.
 - d. Operating Temperature: 32°F to 120°F.
 - e. Ambient Humidity: 10% to 93% RH non-condensing.
 - f. Wiring: 12-2 to 18-2 AWG.
 - g. Mounting: 4" x 4" electrical box, outside main entry/exit door. Label combination horns and strobes.
 - h. Candela Settings: 15/30/75/110cd output (adjustable).
 - i. Audible Tone Settings: Continuous / Temporal (adjustable).

2.13 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS

- A. Furnish local UPS units, of type indicated, installed with DDC system.
- B. DIN Rail Mounted UPS:
 - 1. Provide continuous, regulated output power without using batteries during brown-out, surge, and spike conditions.
 - 2. Performance:
 - a. Capacity: Load not to exceed 75 percent of rated capacity.
 - b. Efficiency: Minimum 94 percent.
 - c. Input Voltage: Single phase, 120 V ac, compatible with field power source.
 - d. Load Power Factor Range (Crest Factor): 0.65 to 1.0.
 - e. Output Voltage: 101 to 132 V ac, while input voltage varies between 89 and 152 V ac.
 - f. On Battery Output Voltage: Sine wave.
 - g. Inverter Overload Capacity: Minimum 150 percent for 30 seconds.
 - h. Battery Backup: Five minutes of operation at full load with battery power.
 - i. Battery Recharge Time: Maximum of six hours to 90 percent capacity after full discharge.
 - j. Transfer Time: 6 ms.
 - k. Surge Voltage Withstand Capacity: IEEE C62.41.1 and IEEE C62.41.2, Categories A and B.
 - 3. Automatic bypass operation during fault or overload conditions.
 - 4. Integral line-interactive, power condition topology to eliminate all power contaminants.
 - 5. Include power switch and visual indication of power, battery, fault, and temperature.
 - 6. Include audible alarm of faults with silence feature.
 - 7. Include dry contacts (digital output points) for low battery condition and battery-on (primary utility power failure) and connect points to BAS system.
 - 8. Batteries: Sealed; maintenance free; replacement without dropping load.
- C. Tower UPS Models through 1000 VA:
 - 1. Provide continuous, regulated output power without using batteries during brown-out, surge, and spike conditions.
 - 2. Performance:
 - a. Capacity: Load not to exceed 75 percent of rated capacity.
 - b. Efficiency: Complying with ENERGY STAR requirements; minimum 91 percent.
 - c. Input Voltage: Single phase, 120 V ac, compatible with field power source.
 - d. Load Power Factor Range (Crest Factor): 0.65 to 1.0.
 - e. Output Voltage: 101 to 132 V ac, while input voltage varies between 89 and 152 V ac.
 - f. On Battery Output Voltage: Sine wave.
 - g. Inverter Overload Capacity: Minimum 150 percent for 30 seconds.
 - h. Battery Backup: Five minutes of operation at full load with battery power.
 - i. Battery Recharge Time: Maximum of four hours to 90 percent capacity after full discharge to cutoff.
 - j. Transfer Time: 0 ms.
 - k. Surge Voltage Withstand Capacity: IEEE C62.41.1 and IEEE C62.41.2, Categories A and B; 6 kV/200 and 500 A; 100 kHz ring wave.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Automatic bypass operation during fault or overload conditions.
4. Integral line-interactive, power condition topology to eliminate all power contaminants.
5. Include power switch and visual indication of power, battery, fault, and temperature.
6. Include audible alarm of faults and front panel silence feature.
7. Receptacles: Minimum four>, NEMA WD 1, NEMA WD 6 Configuration 5-15R receptacles.
8. Remote Alarms: Include dry contacts (digital output points) or serial communication interface for low battery condition and battery-on (primary utility power failure) and connect points to BAS system.
9. Batteries: Sealed type; maintenance free. Battery replacement is to be front accessible by user without dropping load.
10. Install tower models in enclosures rated for location.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify compatibility with and suitability of substrates.
- B. Examine roughing-in for products to verify actual locations of connections before installation.
 1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
 2. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BAS SPECIFIC REQUIREMENTS

- A. Graphic Displays
 1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
 2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.
- B. Actuation / Control Type

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Primary Equipment
 - a. Controls shall be provided by equipment manufacturer as specified herein.
 - b. All damper and valve actuation shall be electric.
2. Air Handling Equipment
 - a. All air handlers shall be controlled with a HVAC-DDC Controller
 - b. All damper and valve actuation shall be electric.
3. Terminal Equipment:
 - a. Terminal Units (VAV, FCU etc.) shall have electric damper and valve actuation.
 - b. All terminal units shall be controlled with HVAC-DDC Controller.

3.3 INSTALLATION

A. BAS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation, as herein specified, shall be provided by the BAS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring
 - a. All Class 2 (24VAC or less) wiring shall be installed in conduit.
 - b. Concealed, inaccessible wiring shall be installed in conduit and routed to above nearest accessible ceiling.
 - c. Concealed, accessible wiring does not need to be installed in conduit but shall be plenum rated.
 - d. Conduit shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BAS Raceway

1. All wiring shall be installed in blue conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
2. Where it is not possible to conceal raceways in finished locations, surface raceway (wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
- C. Penetrations
1. Provide fire stopping for all penetrations used by dedicated BAS conduits and raceways.
 2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
 3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
 4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
- D. BAS Panel Installation
1. The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
 2. The BAS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.
- E. Input Devices
1. All Input devices shall be installed per the manufacturer recommendation.
 2. Locate components of the BAS in accessible local control panels wherever possible.
- F. HVAC Input Devices – General
1. All Input devices shall be installed per the manufacturer recommendation.
 2. Locate components of the BAS in accessible local control panels wherever possible.
 3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
 4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
 5. Outside Air Sensors
 - a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
 - b. Sensors shall be installed with a rain proof, perforated cover.
 6. Water Differential Pressure Sensors
 - a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
 - b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
 - c. The transmitters shall be installed in an accessible location wherever possible.
 7. Medium to High Differential Water Pressure Applications (Over 21" w.c.):
 - a. Air bleed units, bypass valves and compression fittings shall be provided.
 8. Building Differential Air Pressure Applications (-1" to +1" w.c.):
 - a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.

- b. The interior tip shall be inconspicuous and located as shown on the drawings.
- 9. Duct Temperature Sensors:
 - a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
 - b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
 - c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
 - d. The sensor shall be mounted to suitable supports using factory approved element holders.
- 10. Space Sensors:
 - a. Shall be coordinated with Architectural plans and mounted per ADA requirements.
 - b. In public areas and/or where indicated on plans, provide sensors without controls interface, and/or a lockable interface.
 - c. Space air temperature sensors shall be provided in all Electrical, AV, IT, Data, Telecom (TR) and Server rooms. Sensors shall be provided with digital display of sensed temperature.
- 11. Low Temperature Limit Switches:
 - a. Install on the discharge side of the first water or steam coil in the air stream.
 - b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
 - c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
- 12. Air Differential Pressure Status Switches:
 - a. Static pressure tips, tubing, fittings, and air filter.
- 13. Water Differential Pressure Status Switches:
 - a. with shut off valves for isolation.
- 14. Do not cover or conceal sensors with insulation.

G. HVAC Output Devices

- 1. All output devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
- 2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
- 3. Control Valves:
 - a. Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
 - b. Install valves in piping with stems as vertical as possible but in no case less than forty-five (45) degrees from vertical. For soldered or welded connections, remove valve internals before installation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Wire electric valves in accordance with NFPA 70 with not less than two (2) feet of flexible liquidtight connector with watertight bushings at the valve actuator and conduit termination. Brace conduit to the building structure to prevent movement and damage.
 - 4. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Automation is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.
- H. Label Installation
- 1. Install or permanently fasten labels on each major item of temperature control equipment.
 - 2. Locate labels where accessible and visible.
 - 3. For equipment, devices, sensors, etc. located above the ceiling, in addition to a label on the equipment, labels are to be permanently affixed to the ceiling grid framing as near to the item as possible using epoxy glue. Where hard ceilings are used, the label is to be affixed to the frame of the access panel for the unit.

3.4 TRAINING

- A. The manufacturer shall provide a factory trained instructor to give not less than 8 hours of full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach.
- B. Provide training for Owner's designated operating personnel. Training shall include:
 - 1. Explanation of drawings, operations and maintenance manuals
 - 2. Walk-through of the job to locate control components
 - 3. Operator workstation and peripherals
 - 4. DDC controller and ASC operation/function
 - 5. Operator control functions including graphic generation and field panel programming
 - 6. Explanation of adjustment, calibration and replacement procedures
 - 7. Electronic Catalog and Materials
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Manufacturer. If such training is required by the Owner, it will be contracted at a later date.

3.5 COMMISSIONING, TESTING AND ACCEPTANCE

- A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning.
- B. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

system or deviation from normal function shall be performed when the operation of the system is not required.

- C. The commissioning must be coordinated with the owner and contractor to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.
 - 1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications, and approved shop drawings. Test, calibrate and bring online each control sensor and device. Commissioning to include, but not be limited to:
 - a. Sensor accuracy at 10, 50 and 90% of range.
 - b. Sensor range.
 - c. Verify analog limit and binary alarm reporting.
 - d. Point value reporting.
 - e. Binary alarm and switch settings.
 - f. Actuator ranges.
 - g. Fail safe operation on loss of control signal, electric power, network communications.
- D. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BAS program shall be put online and commissioned. The BAS contractor shall, in the presence of the owner and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracies. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.
- E. After all BAS programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:
 - 1. Data communication, both normal and failure modes.
 - 2. Fully loaded system response time.
 - 3. Impact of component failures on system performance and system operation.
 - 4. Time/Date changes.
 - 5. End of month/ end of year operation.
 - 6. Season changeover.
 - 7. Global application programs and point sharing.
 - 8. System backup and reloading.
 - 9. System status displays.
 - 10. Diagnostic functions.
 - 11. Power failure routines.
 - 12. Battery backup.
 - 13. Smoke Control, stair pressurization, stair, vents, in concert with Fire Alarm System testing (if applicable).
 - 14. Testing of all electrical and HVAC systems with other division of work.
- F. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

sensors and control devices maintain specified accuracies and the system performance does not degrade over time.

- G. Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate all system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.
- H. The contractor shall supply all instruments for testing.
 - 1. Test Instrument Accuracy:
 - a. Temperature: $\frac{1}{4}$ °F or $\frac{1}{2}\%$ full scale, whichever is less.
 - b. High Pressure: $\frac{1}{2}$ psi or $\frac{1}{2}\%$ full scale, whichever is less.
 - c. Low Pressure: $\frac{1}{2}\%$ full scale
 - d. Humidity: 2% RH
 - e. Electrical: $\frac{1}{4}\%$ full scale
- I. After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty-day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the owner may request that performance tests be repeated.

3.6 COMMISSIONING, TESTING AND ACCEPTANCE

- A. BAS contractor to the review of the commissioning test scripts, pre-test all system prior to the commissioning functional testing, participate in the commissioning functional testing, be on-site in the Warranty phase during the off-season HVAC testing for heating and cooling functional max load testing.
 - 1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications, and approved shop drawings. Test, calibrate and bring online each control sensor and device.
 - 2. Pre-testing to include, but not be limited to:
 - a. Sensor accuracy at 10, 50 and 90% of range.
 - b. Sensor range.
 - c. Verify analog limit and binary alarm reporting.
 - d. Point value reporting.
 - e. Binary alarm and switch settings.
 - f. Actuator ranges.
 - g. Fail safe operation on loss of control signal, electric power, network communications.
- B. BAS contractor shall submit a written "Certificate of Readiness" that indicates all systems have been pre-tested using the Approved Commissioning Functional Test Scripts and resolved all issues with sequences and devices, confirming the BAS is ready for Commissioning Functional Testing.
 - 1. Certificate of Readiness should be submitted one week prior to the start of the Commissioning Functional Testing and the GC/CM should factor this timing into their Master Construction Schedule.
- C. The BAS contractor shall supply all instruments for testing.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Test Instrument Accuracy:
 - a. Temperature: $\frac{1}{4}$ °F or $\frac{1}{2}\%$ full scale, whichever is less.
 - b. High Pressure: $\frac{1}{2}$ psi or $\frac{1}{2}\%$ full scale, whichever is less.
 - c. Low Pressure: $\frac{1}{2}\%$ full scale
 - d. Humidity: 2% RH
 - e. Electrical: $\frac{1}{4}\%$ full scale

3.7 TEMPERATURE CONTROL

- A. The control sequence of operations describe the general operational intent of the control systems. Provide all hardware, software, devices, equipment and wiring as required to perform the operational intent described by the various control sequences and to fully interface with the building automation system (BAS).
- B. The control diagrams indicate the general arrangement of system components to the extent that they affect process flow or control. Not all required components are shown on the control diagrams. The contractor shall thoroughly review all contract documents to ascertain the full scope of their work.
- C. A full communication interface and complete interoperability with the BAS shall be provided to perform the functions herein described or indicated in the contract documents.
- D. For equipment with factory controllers:
 1. The BAS provider and the equipment manufacturer shall provide a complete list of all BACNET points available to be accessed from within the manufacturer's factory controllers and, specifically, identify what points can be read from the BAS, which points can be written too and which points cannot be accessed at all.
 2. The BAS submittal, sequences and points list shall indicate routines that are controlled completely from the manufacturer's controllers, which routines are controlled partially by the manufacturer's controllers and BAS and which routines are controlled completely by the BAS.
 3. The BAS provider and equipment manufacturer, in collaboration, shall provide coordinated submittals that indicate anything that has to be set, reset or accessed in a manufacturer's controller at the piece of equipment as opposed to being accessed at or from the BAS user interface/controller console. This coordination and collaboration shall occur at the submittal phase and well before equipment and controls are delivered to the site.
- E. Unless otherwise noted, size all automatic control valves for maximum ten (10) feet water pressure drop at maximum design flow rate.
- F. Refer to drawings for locations of all terminal units, room sensors, panels, dampers, valves, and equipment; where such devices are not indicated, however are required by the control sequences to achieve the intended operation, they shall be provided and located in the field where directed by the engineer.
- G. Division 26 shall provide all detection devices (heat/smoke) as required by the contract documents. Division 23 shall install all detection devices including required control and power wiring required for mechanical systems. Detection devices shall provide

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

automatic shutdown of the HVAC systems in accordance with the International Mechanical Code.

- H. All pumps and fans shall be provided with a differential pressure sensor installed around the pump or fan. Sensor shall provide status indication for pump or fan operation. Current sensors with VA memory may be used instead of differential pressure sensors where indicated or noted.
- I. Adjustable freezestats shall be provided at all preheat and heating coils and shall de-energize their respective air handling system when their setting of 35°F is reached. Freezestats for water coils shall be installed in the coil leaving air stream. Freezestats shall be hard wired in the motor starter circuit and send an alarm signal to the BAS when they are activated.
- J. All temperature, humidity, pressure, time, etc. set points shall be fully adjustable through the BAS. Final system setpoints will be confirmed through system commissioning and fixed prior to building occupancy. Thereafter setpoints shall be adjustable through the BAS by trained maintenance staff.
- K. All two position dampers and valves shall be proven open by the use of end switches.
- L. All control devices located within chemical storage areas shall be explosion proof suitably rated for each specific application.
- M. Refer to individual input/output summary schedules for additional control devices not specifically described in the control narratives. Input/output summary schedules are minimum requirements; provide all required points for complete operation of the systems.
- N. All variable frequency drives (VFD) for fans and pumps shall be soft started at minimum speed and increased to required operating speed by the BAS.
- O. Refer to drawings for fans that shall be equipped with an inlet air monitoring device (AMD). Where provided, the BAS shall continuously monitor the airflow rate for the fan. AMD's for exhaust fans shall be of a material suitable for the intended airstream.
- P. Upon failure of any direct digital control (DDC) unit, an alarm shall be indicated on the BAS and the system shall automatically revert to the default cycle. All motors and fans shall remain in their last commanded state. When emergency power is available, the BAS shall monitor each essential power transfer switch and ramp the VFD's of selected fans and pumps to their lower limits until the emergency generator is stable and online; at which time the normal sequence of operations shall resume for selected fans and pumps.
- Q. In general and unless otherwise noted, heating control valves shall fail open, specialist area heating control valves shall fail closed, steam control valves shall fail closed, chilled water control valves shall fail closed. Isolation dampers at fans and air units shall fail open.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- R. Standby chillers, boilers, heat pumps, fans and pumps shall be alternated into operation every 500 hours. The BAS shall alarm for change over; actual change over shall be initiated by trained maintenance personnel through the BAS.
- S. HVAC system controls shall not fail and lock out upon loss of power (such as under emergency conditions) and loss of power shall not be alarmed to the BAS.
- T. Where used to control both comfort heating and cooling, zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum. Variable air volume (VAV) terminal units shall be programmed to operate at the minimum airflow setting without addition of reheat when the zone temperature is within the set dead band.

END OF SECTION 230900

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round and flat-oval ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Duct liner.
 - 5. Sealants and gaskets.
 - 6. Hangers and supports.
 - 7. Seismic-restraint devices.
- B. Related Sections:
 - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
 - 3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Seismic-restraint devices.
- B. Shop Drawings:
 - 1. Factory- and shop-fabricated ducts and fittings.
 - 2. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 3. Elevation of top and bottom of ducts.
 - 4. Dimensions of main duct runs from building grid lines.
 - 5. Fittings.
 - 6. Reinforcement and spacing.
 - 7. Seam and joint construction.
 - 8. Penetrations through fire-rated and other partitions.
 - 9. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 10. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 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 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/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

- A. Comply with requirements in "Duct Schedule" Article for applications of duct material, pressure class, duct seal-class level, and duct-leakage class.

2.2 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.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Fabricate joints in accordance with 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."
 - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
 - 3. Where specified for specific applications, all joints shall be welded.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with 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."
 - 1. All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.
 - 2. Where specified for specific applications, all joints are to be welded.
 - 3. Round snaplock duct with longitudinal seam shall be acceptable for positive, low-pressure (2-inch wg and less) branch duct runouts to air devices.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 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."

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Source Limitations: Obtain single-wall round and flat oval ducts and fittings from single manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- D. Transverse Joints: Select joint types and fabricate in accordance with 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.
- E. Longitudinal Seams: Select seam types and fabricate in accordance with 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.
- F. Tees and Laterals: Select types and fabricate in accordance with 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."

2.4 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: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. 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.
- D. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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.

2.5 DUCT LINER

- A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC
 - c. Ductmate Industries, Inc
 - d. Evonik Foams
 - e. K-Flex USA
 2. Source Limitations: Obtain flexible elastomeric duct liner from single manufacturer.
 3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
- 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 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 or greater.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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. 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.

2.6 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. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
 1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive and Exterior 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.

2.8 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business
 - 2. Ductmate Industries, Inc
 - 3. Hilti, Inc.
 - 4. Kinetics Noise Control, Inc
 - 5. Mason Industries, Inc.
 - 6. Unistrut; Part of Atkore International
 - 7. Vibration & Seismic Technologies, LLC
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service, the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

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. Sizes shown on plans are air side sizes. Where ducts are shown as lined, dimensions shall be increased to reflect that thickness of the lining.
- D. Install ducts in maximum practical lengths 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

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

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 233300 "Air Duct Accessories" for fire and smoke dampers.
 - L. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
 - M. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
 - N. Protect duct 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" for an Advanced level of cleanliness.
 - 1. For work that does not comply with these requirements, at the Architect's or Owner representative's discretion the contractor shall:
 - a. Clean and restore all impacted air-moving and -distribution equipment to an advanced level of cleanliness in accordance with NADCA ACR 2013, Assessment, Cleaning & Restoration of HVAC Systems, including all items identified in the Standard as "recommended," "advised," and "suggested."
 - b. Verify cleanliness according to NADCA ACR 2013, "Verification of HVAC System Cleanliness" Section.
 - O. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
 - P. Branch Connections: Use lateral or conical branch connections.
- 3.2 ADDITIONAL INSTALLATION REQUIREMENTS FOR LABORATORY EXHAUST DUCTS
- A. Install ducts in accordance with NFPA 45, "Fire Protection for Laboratories Using Chemicals."
 - B. Install exhaust ducts without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to hood or inlet. Where indicated on Drawings, install trapped drain piping.
 - C. Connect duct to fan, fume hood, and other equipment indicated on Drawings.
 - 1. Connect ducts to fume hoods with long radius elbows.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR CLOTHES DRYER EXHAUST DUCT

- A. Dryer exhaust ducts for clothes dryers shall terminate on the outside of the building and shall be equipped with a backdraft damper.
- B. Screens shall not be installed at the duct termination. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust flow.
- C. Exhaust ducts shall be supported at 4-foot intervals and secured in place.
- D. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Ducts shall not be joined with screws or similar fasteners that protrude into the inside of the duct.
- E. Each vertical riser shall be provided with a means for cleanout.
- F. The maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions.

3.4 DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to be welded. Seal all openings to provide weatherproof construction.
- B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
- C. Single Wall:
 - 1. Ductwork is to be Type 304 stainless steel.
 - 2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

3.5 DUCT SEALING

- A. Ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A, as required to meet the requirements of ASHRAE/IES 90.1.
- B. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage.
- C. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment.
- D. Spiral lock seams need not be sealed.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.6 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.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- 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 Concealed From View: Threaded rod and angle or channel supports.
- E. Hangers Exposed to View:
 - 1. Rectangular: Threaded rod and angle or channel supports.
 - 2. Round or Oval: Steel cables.
- F. 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.
- G. 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.

3.7 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. See Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraint installation requirements..

3.8 DUCTWORK CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.9 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner.
 - 1. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.
- B. Paint materials and application requirements are specified in Division 09.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - b. Laboratory Exhaust Ducts with a Pressure Class of 3-Inch wg or Higher: Test duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - c. Kitchen Exhaust Hood Ductwork: Test duct sections totaling no less than 100 percent of total installed duct area.
 - d. Dishwasher Hoods, Cagewash and Autoclave Ductwork: Test duct sections totaling no less than 100 percent of total installed duct area.
 - e. All vertical ductwork located within risers, chases and shafts shall be leak tested. The tests shall include each branch connection tap up to a point just beyond the shaft wall.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
 - 5. Test for leaks before applying external insulation.
 - 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - 7. Give seven days' advance notice for testing. 3-5 days prior to each test, the contractor shall submit marked-up sheetmetal shop drawings of the duct section(s) to be tested, along with the allowable leakage calculations as required by SMACNA.
 - 8. Additional tests of each pressure classification shall be required, at the owner's, Architect's or TAB contractors discretion, if subsequent ductwork installation becomes suspect and does not appear to maintain the same level of quality as the section tested.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. At the Owner's discretion, at no additional cost the contractor shall test sections of metal duct system for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply Air Ducts:
 - 1. Ducts Connected to Multi-Zone Air-Handling Units, downstream, from air handling units to terminal units:
 - a. Concealed: Single wall, round, oval or rectangular as shown on drawings.
 - b. Exposed to View: Double wall, round, oval or rectangular as shown on drawings.
 - c. Pressure Class: Positive 6-inch wg.
 - d. SMACNA Seal Class: A.
 - e. SMACNA Leakage Class for Rectangular: 4.
 - f. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 2. Ducts Connected to Single-Zone Air-Handling Units, downstream, from air handling units to air device:
 - a. Concealed: Single wall, round, oval or rectangular as shown on drawings.
 - b. Exposed to View: Double wall, round, oval or rectangular as shown on drawings.
 - c. Pressure Class: Positive 2-inch wg.
 - d. SMACNA Seal Class: A.
 - e. SMACNA Leakage Class for Rectangular: 4.
 - f. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 3. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units, downstream, from unit to air device:
 - a. Concealed: Single wall, round, oval or rectangular as shown on drawings.
 - b. Exposed to View: Double wall, round, oval or rectangular as shown on drawings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Pressure Class: Positive 2-inch wg.
 - d. SMACNA Seal Class: A.
 - e. SMACNA Leakage Class for Rectangular: 4.
 - f. SMACNA Leakage Class for Round and Flat Oval: 2.
- C. Return Air and Transfer Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Single wall, round, oval or rectangular as shown on drawings.
 - b. Pressure Class: Positive or negative 2-inch wg.
 - c. SMACNA Seal Class: A.
 - d. SMACNA Leakage Class for Rectangular: 12.
 - e. SMACNA Leakage Class for Round and Flat Oval: 6.
 - 2. Transfer Ducts:
 - a. Single wall, round, oval or rectangular as shown on drawings.
 - b. Pressure Class: Positive or negative 2-inch wg.
 - c. SMACNA Seal Class: A.
 - d. SMACNA Leakage Class for Rectangular: 4.
 - e. SMACNA Leakage Class for Round and Flat Oval: 2.
- D. Exhaust Air Ducts:
 - 1. Ducts Connected to Fans Exhausting General and Toilet Air (ASHRAE 62.1, Class 1 and 2):
 - a. Single wall, round, oval or rectangular as shown on drawings.
 - b. Pressure Class: Negative 2-inch wg.
 - c. SMACNA Seal Class: A.
 - d. SMACNA Leakage Class for Rectangular: 4.
 - e. SMACNA Leakage Class for Round and Flat Oval: 2.
 - 2. Ducts Connected to Fans Exhausting Laboratory and Process Air (ASHRAE 62.1, Class 3 and 4):
 - a. Single wall, round, oval or rectangular as shown on drawings.
 - b. Material: Type 316, stainless-steel sheet.
 - 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2D finish.
 - c. Pressure Class: Negative 4-inch wg.
 - d. Welded seams, joints, and penetrations.
 - e. Airtight/Watertight.
 - 3. Ducts Connected to Clothes Dryers:
 - a. Single wall, round, oval or rectangular as shown on drawings.
 - b. Material: Aluminum
 - c. Pressure Class: Positive 2-inch wg.
 - d. SMACNA Seal Class: A.
 - e. SMACNA Leakage Class for Rectangular: 4.
 - f. SMACNA Leakage Class for Round and Flat Oval: 2.
- E. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. Stainless-Steel Ducts: Stainless steel.
 - 3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.
- F. Liner:
 - 1. Transfer Ducts: Flexible elastomeric, 1 inch thick.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- G. Double-Wall Duct Interstitial Insulation:
 - 1. Supply Air Ducts: Flexible elastomeric, 2 inches thick.
- H. Elbow Configuration:
 - 1. 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."
 - 2. 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) 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.
- 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: Spin in.
 - 1) In no case should the round branch plus associated flange be larger than the height of rectangular main. Where the condition exists, provide a rectangular main to rectangular branch with 45-degree entry, and transition to round duct.
 - 2. Round and Flat Oval: 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 233113

SECTION 233300 - AIR DUCT ACCESSORIES

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. Backdraft dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Fire dampers.
 - 5. Smoke dampers.
 - 6. Combination fire and smoke dampers.
 - 7. Flange connectors.
 - 8. Turning vanes.
 - 9. Duct-mounted access doors.
 - 10. Flexible connectors.
 - 11. Flexible ducts.
 - 12. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- f. If equipment includes wiring, include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- B. 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.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- 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.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.3 BACKDRAFT DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Flexmaster U.S.A., Inc.
 - 4. McGill AirFlow LLC.
 - 5. Nailor Industries Inc.
 - 6. NCA Manufacturing, Inc; a division of Metal Industries Inc.
 - 7. Pottorff.
 - 8. Ruskin Company.
 - 9. Tamco; T. A. Morrison & Co., Inc.
 - 10. Trox USA Inc.
 - 11. United Enertech
 - 12. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Performance:
 - 1. Maximum Air Velocity: 2500 fpm.
 - 2. Maximum System Pressure: 2-inch wg.
 - 3. Leakage:
 - a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
- D. Construction:
 - 1. Frame:
 - a. Hat-shaped.
 - b. 16-gauge- thick galvanized sheet steel, 0.090-inch- thick extruded aluminum, or 18-gauge- thick stainless steel, with welded or mechanically attached corners and mounting flange. Material shall match duct system.
 - 2. Blades:
 - a. Multiple single-piece blades.
 - b. End pivoted, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.
 - 3. Blade Action: Parallel.
 - 4. Blade Seals: Extruded vinyl or neoprene, mechanically locked.
 - 5. Blade Axles:
 - a. Material: Aluminum.
 - b. Diameter: 0.20 inch.
 - 6. Tie Bars and Brackets: Aluminum.
 - 7. Return Spring: Adjustable tension.
 - 8. Bearings: Synthetic pivot bushings.
- E. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Chain pulls.
 - 4. Screen Mounting:
 - a. Rear mounted in sleeve.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 1) Sleeve Thickness: 20 gauge minimum.
- 2) Sleeve Length: 6 inches minimum.
5. Screen Material: Aluminum.
6. Screen Type: Insect.
7. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a Mestek Architectural Group company
 - b. McGill AirFlow LLC
 - c. Nailor Industries Inc
 - d. NCA Manufacturing, Inc; a division of Metal Industries Inc.
 - e. Pottorff
 - f. Ruskin Company
 - g. Trox USA Inc.
 - h. United Enertech
 - i. Vent Products Co., Inc
2. Performance:
 - a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure
3. Construction:
 - a. Linkage outside of airstream.
 - b. Suitable for horizontal or vertical applications.
4. Frames:
 - a. Hat-shaped, 16-gauge- thick, galvanized sheet steel or 18-gauge- thick stainless steel. Damper material shall match duct material.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized or stainless steel; 16 gauge thick. Blade material shall match duct material.
6. Blade Axles: Galvanized steel or stainless steel, hex. Axle material shall match duct material.
7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.
9. Locking device to hold damper blades in a fixed position without vibration.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. American Warming and Ventilating; a Mestek Architectural Group company
 - b. McGill AirFlow LLC
 - c. Nailor Industries Inc
 - d. NCA Manufacturing, Inc; a division of Metal Industries Inc.
 - e. Pottorff
 - f. Ruskin Company
 - g. Trox USA Inc.
 - h. United Enertech
 - i. Vent Products Co., Inc
 2. Performance:
 - a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure
 3. Construction:
 - a. Linkage outside of airstream.
 - b. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Hat-shaped, 0.10-inch- thick, aluminum sheet channels.
 - b. Flanges for attaching to walls and flangeless frames for installing in ducts.
 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 - e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 6. Blade Axles: Nonferrous metal.
 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Aluminum.
 9. Locking device to hold damper blades in a fixed position without vibration.
- C. Jackshaft:
1. Size: 0.5-inch diameter.
 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Arrow United Industries
 2. Cesco Products; a division of MESTEK, Inc.
 3. Greenheck Fan Corporation
 4. Nailor Industries Inc
 5. NCA Manufacturing, Inc; a division of Metal Industries Inc.
 6. Pottorff
 7. Ruskin Company
 8. United Enertech
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
1. Dynamic: Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- C. Fire Rating: 1-1/2 hours. 3-hour dampers shall be installed where required by wall or floor rating.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 20 gauge thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 24 gauge thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- J. Provide Type 304, stainless steel frames, sleeves and blades for installation in stainless steel ductwork.

2.6 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cesco Products; a division of MESTEK, Inc.
 2. Greenheck Fan Corporation
 3. Nailor Industries Inc
 4. NCA Manufacturing, Inc; a division of Metal Industries Inc.
 5. Pottorff
 6. Ruskin Company
 7. United Enertech

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

B. General Requirements:

1. Label to indicate conformance to UL 555 and UL 555S by an NRTL.
2. Label to indicate conformance to NFPA 80 and NFPA 90A by an NRTL.
3. Unless otherwise indicated, use parallel-blade configuration.
4. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.
5. Factory install damper actuator by damper manufacturer as integral part of damper assembly. Coordinate actuator location, mounting, and electrical requirements with damper manufacturer.

C. Performance:

1. AMCA Certification: Test and rate in accordance with AMCA Publication 511.
2. Leakage:
 - a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Suitable for horizontal or vertical airflow applications.
2. Linkage out of airstream.
3. Frame:
 - a. Hat shaped.
 - b. Galvanized sheet steel, with welded or mechanically attached corners and mounting flange.
 - c. Gauge in accordance with UL listing.
4. Blades:
 - a. Roll-formed, horizontal, airfoil, galvanized sheet steel.
 - b. Maximum width and gauge in accordance with UL listing.
5. Blade Edging Seals:
 - a. Silicone rubber.
6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings. Linkage is to be mounted out of airstream.
8. Bearings:
 - a. Molded synthetic or stainless steel sleeve.

E. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application; gauge in accordance with UL listing.

F. Damper Actuator - Electric:

1. Electrical Connection: 115 V, single phase, 60 Hz.
2. UL 873, plenum rated.
3. Designed to operate in smoke-control systems complying with UL 555S requirements.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Two position or fully modulating (as required for application) with fail-safe spring return.
 - a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
 - b. Maximum 15-second full-stroke closure.
 - c. Minimum 90-degree drive rotation.
 5. Clockwise or counterclockwise drive rotation as required for application.
 6. Environmental Operating Range:
 - a. Temperature: Minus 40 to plus 130 deg F.
 - b. Humidity: 5 to 95 percent relative humidity noncondensing.
 7. Environmental Enclosure: NEMA 2.
 8. Actuator to be factory mounted and provided with single-point wiring connection.
- G. Accessories:
1. Auxiliary switches for signaling, fan control or position indication.
 2. Test and reset switches: Damper mounted if easily accessible, otherwise remote mounted.
- H. Provide Type 304, stainless steel frames, axles, sleeves and blades for installation in stainless steel ductwork.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cesco Products; a division of MESTEK, Inc.
 2. Greenheck Fan Corporation
 3. Nailor Industries Inc
 4. NCA Manufacturing, Inc; a division of Metal Industries Inc.
 5. Pottorff
 6. Ruskin Company
 7. United Enertech
- B. General Requirements:
1. Label to indicate conformance to UL 555 and UL 555S by an NRTL.
 2. Label to indicate conformance to NFPA 80 and NFPA 90A by an NRTL.
 3. Unless otherwise indicated, use parallel-blade configuration.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000 fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Performance:
1. AMCA Certification: Test and rate in accordance with AMCE Publication 511.
 2. Leakage:
 - a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
 3. Pressure Drop: 0.05 in. wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Velocity: Up to 3000 fpm.
 5. Temperature: Minus 25 to plus 180 deg F.
 6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
- F. Construction:
1. Suitable for horizontal or vertical airflow applications.
 2. Linkage out of airstream.
 3. Frame:
 - a. Hat shaped.
 - b. Galvanized sheet steel, with welded or mechanically attached corners and mounting flange.
 - c. Gauge is to be in accordance with UL listing.
 4. Blades:
 - a. Roll-formed, horizontal, airfoil, galvanized sheet steel.
 - b. Maximum width and gauge in accordance with UL listing.
 5. Blade Edging Seals:
 - a. Silicone rubber.
 6. Blade Jamb Seal: Flexible stainless steel, compression type.
 7. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of airstream.
 8. Bearings:
 - a. Molded synthetic or stainless steel sleeve.
- G. Mounting Sleeve:
1. Factory installed, galvanized sheet steel.
 2. Length to suit wall or floor application.
 3. Gauge in accordance with UL listing.
- H. Heat-Responsive Device:
1. Resettable, resettable device and switch package, factory installed, rated.
- I. Damper Actuator - Electric:
1. Electrical Connection: 115 V, single phase, 60 Hz.
 2. UL 873, plenum rated.
 3. Designed to operate in smoke-control systems complying with UL 555S requirements.
 4. Two position or fully modulating (as required for application) with fail-safe spring return.
 - a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
 - b. Maximum 15-second full-stroke closure.
 - c. Minimum 90-degree drive rotation.
 5. Clockwise or counterclockwise drive rotation as required for application.
 6. Environmental Operating Range:
 - a. Temperature: Minus 40 to plus 130 deg F.
 - b. Humidity: 5 to 95 percent relative humidity noncondensing.
 7. Environmental Enclosure: NEMA 2.
 8. Actuator to be factory mounted and provided with single-point wiring connection.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- J. Accessories:
 - 1. Auxiliary switches for signaling, fan control, or position indication.
 - 2. Test and reset switches: Damper mounted if easily accessible, otherwise remote mounted.
- K. Provide Type 304, stainless steel frames, axles, sleeves and blades for installation in stainless steel ductwork.

2.8 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc
 - 2. Hardcast, Inc.
 - 3. Nexus PDQ
 - 4. Ward Industries; a brand of Hart & Cooley, Inc
- B. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.9 AIR TRANSFER SILENCERS

- A. Return Air Canopy
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Price RAC or comparable product by one of the following:
 - a. Commercial Acoustics
 - b. Dynasonics
 - c. Flex-Tek Group
 - d. Industrial Noise Control, Inc
 - e. McGill AirFlow LLC
 - f. Price
 - g. Ruskin Company
 - 2. General:
 - a. Furnish and install return air canopy air transfer silencers of the size, configuration, and acoustic performance as described on the plans and schedules.
 - 3. Performance:
 - a. Return air canopy performance characteristics, including insertion loss and pressure drop, shall be attained through testing in accordance with ASTM Standard E477.
 - b. Laboratory performance verification in the manufacturer's test facility may be requested, in which case a comparative test report shall be made available to the engineer.
 - 4. Construction:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Return air canopies shall be constructed in accordance with ASHRAE and SMACNA Standards for the pressure and velocity classification specified for the air distribution system in which it is installed.
 - b. Return air canopies shall be constructed of:
 - 1) 24 gauge solid steel casing
 - 2) Acoustic media:
 - a) Fiber free foam liner.
 - c. Acoustic media:
 - 1) Fiber free foam:
 - a) Fiber free foam shall be self-sealing engineered foam that will not expose fibers to the airstream.
 - b) Fiber free foam shall be in accordance with erosion requirements of UL 181, and shall conform to the physical properties and requirements of ASTM C1071.
 - c) Mold growth and humidity requirements shall be in accordance with ASHRAE Standard 62.1.
 - d. Fire-Performance Characteristics:
 - 1) Air transfer silencer assemblies, including acoustic media fill, sealants, and acoustical spacers shall have combustion rating equal to or less than shown below when tested according to ASTM E84, NFPA 255 or UL 723:
 - a) Flame-spread index not exceeding 25
 - b) Smoke-developed index not exceeding 50
- B. Cross Talk Air Transfer Silencer (Transfer Duct)
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Price XTU or comparable product by one of the following:
 - a. Commercial Acoustics
 - b. Dynasonics
 - c. Flex-Tek Group
 - d. Industrial Noise Control, Inc
 - e. McGill AirFlow LLC
 - f. Price
 - g. Ruskin Company
 - 2. Furnish and install cross talk air transfer silencers of the size, configuration, and acoustic performance as described on the plans and schedules.
 - 3. Performance:
 - a. Cross Talk Silencer performance characteristics, including insertion loss and pressure drop, shall be attained through testing in accordance with ASTM Standard E477.
 - b. Laboratory performance verification in the manufacturer's test facility may be requested, in which case a comparative test report shall be made available to the engineer.
 - 4. Construction:
 - a. Cross talk silencers shall be constructed in accordance with ASHRAE and SMACNA Standards for the pressure and velocity classification specified for the air distribution system in which it is installed.
 - b. Cross talk silencers shall be constructed of:
 - 1) 22-gauge solid steel casing
 - 2) 26-gauge solid steel internal noses at inlet and outlet
 - 3) ¾ inch dual density absorptive fiberglass media.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Cross talk silencers shall be fastened with the use of button lock, Pittsburgh lock, and welds. Screws and other types of mechanical fasteners shall not be acceptable.
- d. Acoustic media:
 - 1) Acoustic media shall be shot-free inorganic glass fiber with long, resilient fibers, bonded with thermosetting resin.
 - 2) Glass fiber shall be in accordance with erosion requirements of UL 181, and shall conform to the physical properties and requirements of ASTM C1071.
- e. Fire-Performance Characteristics:
 - 1) Cross talk silencer assemblies, including acoustic media fill, sealants, and acoustical spacers shall have combustion rating equal to or less than shown below when tested according to ASTM E84, NFPA 255 or UL 723:Air Transfer Silencers-3v001
 - a) Flame-spread index not exceeding 25
 - b) Smoke-developed index not exceeding 50

2.10 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aero Dyne Sound Control Co.
 - 2. CL Ward
 - 3. Ductmate Industries
 - 4. Elgen Manufacturing Company, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply 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."
- E. Vane Construction:
 - 1. Double wall.

2.11 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cesco Products; a division of MESTEK, Inc.
 - 2. Ductmate Industries, Inc
 - 3. Flexmaster U.S.A., Inc
 - 4. Greenheck Fan Corporation

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

5. McGill AirFlow LLC
6. Nailor Industries Inc
7. NCA Manufacturing, Inc; a division of Metal Industries Inc
8. Pottorff
9. Ruskin Company
10. United Enertech
11. Ventfabrics, Inc
12. Ward Industries; a brand of Hart & Cooley, Inc

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

D. Provide Type 304, stainless steel door and frames for installation in stainless steel ductwork.

2.12 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M
2. Ductmate Industries, Inc

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Flame Gard, Inc
 4. Ruskin Company
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc
 2. Duro Dyne Inc.
 3. Hardcast, Inc.
 4. Ventfabrics, Inc
 5. Ward Industries; a brand of Hart & Cooley, Inc
- B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Materials: Flame-retardant or noncombustible fabrics.
- E. Coatings and Adhesives: Comply with UL 181, Class 1.
- F. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- G. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.
- H. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..
 2. Tensile Strength: 475 lbf/inch in the warp and 375 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- I. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd..
 - 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.
- J. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.14 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Castco, Model SF-181M.
 - 2. Thermaflex, Model MKE
 - 3. JPL, Model AMR.
- B. Insulated, Acoustical Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 6-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175 deg F.
 - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.
- C. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: Liquid adhesive plus sheet metal screws and tape.
- D. Flexible Duct Elbow Supports:
 - 1. Universal-mount, 1-piece, fully adjustable, radius-forming brace to support 4-inch through 16-inch diameter flexible air ducts.
 - 2. Classified: UL 2043.
 - 3. Material: 100 percent recycled copolymer polypropylene.
 - 4. Support Frame Radius: 8 inches.
 - 5. Compliance for Flexible Duct Radius:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. SMACNA HVAC Duct Construction Standards.
- b. ASHRAE Advanced Energy Design Guides.
- c. ADC Flexible Duct Performance and Installation Standards.

2.15 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install control dampers in exhaust ductwork:
 - 1. For rooftop and base mounted fans, install damper at inlet of exhaust fans or in the exhaust duct close to exhaust fan unless otherwise indicated.
 - 2. For in-line exhaust fans, install damper in exhaust duct downstream of fan as close as possible to exhaust plenum/louver unless otherwise indicated.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
 - 3. Install stainless steel volume dampers in stainless steel ducts.
- F. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- G. Mark the locations of all above-ceiling duct mounted dampers with orange non-adhesive surveyors flagging tape. Exposed duct mounted dampers do not need to be marked.
- H. Set dampers to fully open position before testing, adjusting, and balancing.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- I. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- J. Install fire and smoke dampers according to UL listing.
- K. Duct Smoke Detectors:
 - 1. HVAC duct smoke detectors shall be furnished as specified elsewhere by Division 28 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 28.
 - 2. Comply with NFPA 72 and IMC. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
 - 3. Verify proper length and orientation on the sampling tube. Confirm the sampling tube protrudes into the duct in accordance with system design and per manufacturer's instructions.
 - 4. Verify the smoke detector is rigidly mounted. Confirm that no penetrations in a return air duct exist in the vicinity of the detector. Confirm the detector is installed so as to sample the airstream at the proper location in the duct.
 - 5. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
 - 6. Where duct detectors are used to initiate the operation of smoke dampers, they should be located so that the detector is between the last inlet or outlet upstream of the damper and the first inlet or outlet downstream of the damper.
- L. Connect ducts to duct silencers rigidly.
- M. Duct Lagging:
 - 1. Install acoustical pipe and duct lagging in locations indicated. Comply with manufacturers written instructions for installation by using type of mounting accessories indicated or, if not indicated, as recommended by the manufacturer.
 - 2. Duct shall be wrapped with specified insulation prior to application of the duct lagging.
 - 3. Duct lagging material shall be cut to length, wrapped around the outside of the duct, and fastened with mechanical fasteners, bands or manufacturer's foil lag tape.
 - 4. Duct sound control lagging materials must be installed per the manufacturer's installation guidelines.
- N. Turning Vanes:
 - 1. Factory-manufactured turning vanes with rail system shall be provided in all square and rectangular duct elbows in supply air, return air serving occupied spaces, outdoor air, and all ductwork with maximum air velocities exceeding 1,500 fpm.
 - 2. Installer-fabricated turning vanes shall be permitted only in low-pressure exhaust ductwork located in non-occupied areas, subject to engineer approval.
- O. Fire and Smoke Damper Access and Identification
 - 1. Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts.
 - 2. The access shall not affect the integrity of fire-resistance-rated assemblies.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch in height reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER.
 4. Access doors in ducts shall be tight fitting and suitable for the required duct construction.
- P. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On both sides of duct coils.
 2. Upstream and downstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from control dampers, backdraft dampers, and equipment.
 6. Control devices requiring inspection.
 7. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 8. For grease ducts, install at locations and spacing as required by NFPA 96.
 9. Control devices requiring inspection.
 10. Elsewhere as indicated.
- Q. Install access doors with swing against duct static pressure.
- R. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- S. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- T. Install flexible connectors to connect ducts to equipment.
- U. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- V. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- W. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- X. Connect flexible ducts to metal ducts with draw bands or adhesive plus sheet metal screws.
- Y. Make bends in flexible ducts with minimum of 1-duct diameter centerline radius.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- Z. Where flexible ductwork is used as an elbow, provide flexible, durable duct elbow supports over outer jacket of flexible ducts to form smooth, 90-degree bends to eliminate flexible duct kinks and airflow restrictions.
- AA. Install duct test holes where required for testing and balancing purposes.
- BB. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
 - 5. Operate remote damper operators to verify full range of movement of operator and damper.
 - 6. Test duct smoke detectors per NFPA 72. Detectors that use sampling tubes shall be tested to ensure that they will properly sample the airstream in the duct using a method acceptable to the manufacturer or in accordance with their published instructions. Preferred method is to use a manometer to measure the differential pressure between the two sampling tubes. Verifying the differential pressure is within the manufacturer documented acceptable levels.
 - 7. Test all new fire, smoke and combination fire/smoke dampers both at project completion as well as at the end of the one-year warranty period. Contractor shall provide the test results for both tests on the standard damper testing form.

END OF SECTION 233300

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 233416 - HVAC FANS

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: For each product.
 - 1. HVAC fans.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include rated capacities, furnished specialties, and accessories for each fan.
 - 2. Certified fan performance curves with system operating conditions indicated.
 - 3. Certified fan sound-power ratings.
 - 4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 5. Material thickness and finishes, including color charts.
 - 6. Dampers, including housings, linkages, and operators.
 - 7. Fan speed controllers.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AMCA Compliance:
 - 1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
 - 2. Operating Limits: Classify according to AMCA 99.
- B. Balance Quality:
 - 1. All wheels (rotors/impellers) shall be factory statically and dynamically balanced on precision electronic balancers to a Balance Quality Grade G6.3 per ANSI/AMCA Standard 204-05 or better.
- C. Vibration Levels:
 - 1. Each fan assembly shall be vibration tested before shipping in accordance with AMCA 204-05.
 - 2. Each assembled fan shall be test run at the factory at the specified fan RPM and vibration signatures shall be taken on each bearing in three planes - horizontal, vertical, and axial.
 - 3. Unless otherwise indicated, the maximum allowable factory fan vibration shall be less than 0.15 in./sec peak velocity for rigidly mounted fans and 0.20 in./sec peak velocity for flexibly mounted fans. Values are peak velocity values, filter-in, at the fan rotational speed.
- D. 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.
- E. Capacities and Characteristics: Refer to drawings.

2.2 SQUARE, IN-LINE CENTRIFUGAL FAN, BELT DRIVEN (TYPE K)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Twin City BSI or comparable product by one of the following:
 - 1. American Coolair Corporation
 - 2. Greenheck Fan Corporation
 - 3. Loren Cook Company
 - 4. New York Blower Company (The)
 - 5. Twin City Fan & Blower
- B. Description:
 - 1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven square, in-line fan, consisting of wheel, motor, drive assembly, and support structure.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
- C. Housing: Heavy-gauge galvanized steel with continuously gasketed contact surfaces and square duct mounting collars.
 1. Inlet venturi matched to fan wheel.
 2. Removable side panels for maintenance.
 3. Construct fan to allow complete removal of motor, drives, and fan wheel when side panel is removed.
 4. Universal mounting brackets to allow for horizontal or vertical fan orientation.
- D. Fan Wheels: Aluminum hub and non-overloading wheel with backward-inclined blades, statically and dynamically balanced.
- E. Fan Shaft:
 1. Statically and dynamically balanced and selected for continuous operation at maximum-rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 3. Size shaft for first critical speed minimum 1.25 times maximum speed for each fan class.
 4. Include OSHA compliant shaft and bearing guard.
- F. Grease-Lubricated Shaft Bearings:
 1. Self-aligning, pillow-block-type, spherical roller or anti-friction ball bearings with adapter mount and two-piece, cast-iron housing.
 2. Bearing Rating Life: ABMA L-50 at 500,000 hours at maximum fan RPM.
 3. Provide belt and bearing enclosure to shield from airstream'
- G. Belt Drives:
 1. V-belt drive, factory mounted, with adjustable alignment and belt tensioning.
 2. Service Factor Based on Fan Motor Size: 1.5.
 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 7. Motor Mount: Adjustable for belt tensioning.
- H. Finish: Galvanized mill finish internal parts, and uncoated external parts.
- I. Accessories:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Motor Cover: Provide formed galvanized steel guard to cover the motor and complete drive assembly.
2. Extended lube lines.
3. Pressure Probe: ¼ inch diameter in the fan venturi that allows hook-up to manometer.

2.3 SQUARE INLINE CENTRIFUGAL FANS (EF-1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Loren Cook Company Model SQN-D VF or comparable product by one of the following:
 1. American Coolair Corporation
 2. Greenheck Fan Corporation
 3. Loren Cook Company
 4. New York Blower Company (The)
 5. Twin City Fan & Blower
- B. Description: Direct-drive, duct-mounted square inline centrifugal fan suitable for horizontal or vertical installation, with arrangement and discharge orientation as indicated on Drawings.
- C. Performance: Provide fan sizes, airflows, static pressures, motor horsepower, voltage, phase, and control characteristics as scheduled on Drawings. Fan ratings shall be AMCA certified for air and sound performance.
- D. Housing: Galvanized steel square inline housing with slip-fit duct connections, universal mounting feet or brackets, lifting provisions, and removable access panels arranged to permit inspection and service of wheel, motor, and internal components.
- E. Wheel: Centrifugal fan wheel, factory balanced, mounted for smooth operation at scheduled speed and operating point.
- F. Motor and Speed Control: Provide direct-drive motor compatible with variable fan control where indicated. Provide factory-furnished Vari-Flow, electronically commutated motor control, or VFD-compatible motor/controller package as required to match scheduled fan type and control sequence.
- G. Accessories: Provide accessories where indicated or required for a complete installation, including disconnect switch, motorized or gravity backdraft damper, inlet or discharge guards, vibration isolators, flexible connectors, service access, and factory-furnished controls.
- H. Installation Coordination: Coordinate fan orientation, side-discharge arrangement where used, access-panel location, duct connection, electrical disconnect location, and service clearances before installation.

2.4 LABORATORY EXHAUST AIRFOIL CENTRIFUGAL FANS (EF-2)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Loren Cook Company Model CAVP Vari-Plume or comparable product by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. American Coolair Corporation
 2. Greenheck Fan Corporation
 3. Loren Cook Company
 4. New York Blower Company (The)
 5. Twin City Fan & Blower
- B. Description: Grade-mounted, belt-driven, induced-flow laboratory exhaust fan assembly with airfoil centrifugal wheel and concentric dilution nozzle designed to discharge contaminated exhaust air at high velocity and promote plume rise above grade-mounted equipment location.
- C. Performance: Provide fan sizes, airflows, static pressures, motor horsepower, fan speed, discharge velocity, dilution airflow, plume-rise characteristics, voltage, phase, and control characteristics as scheduled on Drawings. Fan ratings shall be AMCA certified for air and sound performance where applicable.
- D. Fan Assembly: Provide airfoil centrifugal wheel, minimum 12-gauge welded steel fan housing, inlet cone, concrete-curb mounting base or curb cap suitable for mounting on a cast-in-place concrete curb, weather cover, lifting lugs, hinged access door, fan drain, and concentric dilution nozzle. Factory balance fan wheel and assembled fan for smooth operation at scheduled speed and operating point.
- E. Materials and Finish: Provide corrosion-resistant construction suitable for laboratory exhaust service. Finish exposed steel components with phenolic epoxy powder coating with ultraviolet protection. Provide stainless steel shaft, stainless steel hardware, and stainless steel lubrication lines where exposed to contaminated exhaust airstream or weather.
- F. Bearings and Drive: Provide regreasable bearings with minimum L-50 life of 200,000 hours at maximum fan speed. Provide belt drive with minimum 1.5 service factor, adjustable motor base, OSHA-compliant belt and shaft guards, and provisions for final belt alignment and tension adjustment.
- G. Electrical and Controls: Provide NEMA 3R disconnect switch mounted and factory wired where available. Provide motor and control package compatible with scheduled control sequence, including constant-volume or variable-volume operation as indicated.
- H. Accessories: Provide accessories where indicated or required for a complete installation, including concrete-curb mounting base or curb adapter, stack or nozzle extensions, birdscreen, drain connection, isolation damper, inlet flex connector, vibration isolators, bypass or dilution-air components, and factory-furnished controls.
- I. Concrete Curb and Structural Coordination: Provide fan assembly suitable for mounting on a cast-in-place concrete curb at grade. Coordinate concrete curb dimensions, anchorage, service clearances, lifting requirements, drain routing, duct connection, electrical disconnect location, and discharge height with site construction and structural requirements before installation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.5 LOW-PROFILE CEILING EXHAUST FANS (EF-3 and EF-4)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide PennBarry Model ZJ1 Zephyr Jr. low-profile ceiling exhaust fan or comparable product by one of the following:
 - 1. Broan-NuTone LLC
 - 2. Greenheck Fan Corporation
 - 3. PennBarry
 - 4. Twin City Fan & Blower
 - 5. Loren Cook Company
- B. Description: Direct-drive, low-profile, ceiling-mounted cabinet exhaust fan with centrifugal blower, integral backdraft damper, motor, removable fan/motor/wheel power pack, inlet grille, and duct connection suitable for installation in shallow ceiling cavities.
- C. Performance: Provide fan size, airflow, static pressure, motor watts or horsepower, voltage, phase, speed, sound rating, and accessories as scheduled on Drawings. Fan shall be AMCA Air rated and listed in accordance with UL 507 and UL 705 where applicable.
- D. Housing: Galvanized steel cabinet housing with corrosion-resistant fasteners, acoustical lining or insulation where provided by manufacturer, inlet and discharge openings arranged for scheduled duct configuration, and provisions for secure ceiling mounting.
- E. Blower: Forward-curved centrifugal blower wheel, factory balanced, mounted in removable power pack assembly for service and replacement without removal of housing or ductwork.
- F. Motor: Direct-drive, continuous-duty motor with thermal overload protection and positive cooling. Provide motor voltage, phase, speed, and electrical characteristics as scheduled on Drawings.
- G. Damper and Grille: Provide integral chatter-resistant backdraft damper and manufacturer's standard white plastic or metal inlet grille unless otherwise indicated.
- H. Accessories: Provide accessories where indicated or required for a complete installation, including speed controller, ceiling radiation damper, duct transition or top-discharge adapter, mounting brackets, vibration isolation, and electrical disconnect or junction box provisions.
- I. Installation Coordination: Coordinate ceiling opening, grille location, discharge orientation, duct connection, ceiling radiation damper where required, electrical connection, access for power-pack removal, and service clearances before installation.

2.6 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.7 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Install centrifugal fans on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Division 03.
 - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- F. Install units with clearances for service and maintenance.
- G. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete.
 - 3. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 4. Verify that cleaning and adjusting are complete.
 - 5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 6. Trim balance assembled fans to reduce vibration to acceptable operation in-situ START-UP vibration levels in accordance with AMCA Standard 204-05. The final assembly test run shall be provided BEFORE commissioning for service.
 - 7. Adjust belt tension.
 - 8. Adjust damper linkages for proper damper operation.
 - 9. Verify lubrication for bearings and other moving parts.
 - 10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 11. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
 - 12. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 233600 - AIR TERMINAL UNITS

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. Modulating, single-duct air terminal units.
 - 2. Casing liner.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of air terminal unit.
 - 1. Include construction details, material descriptions, dimensions of individual components and pro-files, and finishes for air terminal units.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For air terminal units.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Hangers and supports, including methods for duct and building attachment[, seismic restraints,] and vibration isolation.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Instructions for resetting minimum and maximum air volumes.
 - b. Instructions for adjusting software set points.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.5 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. Fan-Powered-Unit Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a Qualified Electrical Testing Laboratory, and marked for intended location and application.
- B. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."
- D. Seismic Performance: Air terminal units shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

2.2 MODULATING, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carrier Corporation; a unit of United Technologies Corp.
 - 2. ENVIRO-TEC; by Johnson Controls, Inc
 - 3. Johnson Controls
 - 4. METALAIR, Inc
 - 5. Nailor Industries Inc
 - 6. Price Industries
 - 7. Titus
 - 8. Trane
- B. Description: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- C. Casing: Minimum 22-gauge- thick galvanized steel.
 - 1. Casing Liner: Comply with requirements in "Casing Liner" Article below for "Casing Liner, Flexible Elastomeric" Paragraph.
 - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 - 3. Air Outlet: S-slip and drive connections.
 - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
 2. Damper Position: Normally open.
- E. Velocity Sensors: Multipoint array with velocity inlet sensors.
- F. Attenuator Section: Casing material and thickness matching associated air terminal unit casing.
 1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for flexible elastomeric duct liner.
 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- G. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch. Include manual air vent and drain valve. Provide hydronic heating coils for air terminal units scheduled on Drawings.
- H. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless steel, machine-staked terminals secured with stainless steel hardware. Provide electric-resistance heating coils for air terminal units scheduled on Drawings.
 1. SCR controlled.
 2. Access door interlocked disconnect switch.
 3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
 4. Nickel chrome 80/20 heating elements.
 5. Airflow switch for proof of airflow.
 6. Fan interlock contacts.
 7. Fuses in terminal box for overcurrent protection (for coils of more than 48 A).
 8. Pneumatic-electric switches and relays.
- I. Direct Digital Controls: Pressure-independent, VAV controller and integrated actuator, and electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes.
 1. Factory installed controls furnished under Division 23, Section "Building Automation and Temperature Controls".
 2. The terminals shall be equipped with pressure independent controls which can be reset to modulate airflow between zero and the maximum cataloged cubic feet per minute. Maximum airflow limiters are not acceptable.
 3. The direct digital controls shall be supplied by the control contractor and mounted by the terminal unit manufacturer. Control contractor shall provide data sheets on all components to be mounted, indicating component dimensions, mounting hardware, and methods, as well as wiring and piping diagrams for each application identified by unit tag per the schedule in the drawings, to the terminal manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Controls shall be compatible with pneumatic inlet velocity sensors supplied by the terminal manufacturer. The sensor shall be multi-point center averaging type, with a minimum of four measuring ports parallel to the take-off point from the sensor. Sensors with measuring ports in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03 inch wg. at an inlet velocity of 500 fpm. The sensor must provide control signal accuracy of plus or minus five (5) percent with the same size inlet duct at any inlet condition.
5. Controls shall be field set by control contractor for the scheduled minimum and maximum flow rates. Flow measuring taps and flow curves will be supplied with each terminal for field balancing airflow. All pneumatic tubing shall be UL listed fire retardant (FR) type. Each terminal shall be equipped with labeling showing unit location, size, minimum and maximum cubic feet per minute setpoints, damper fail position, and thermostat action.
6. The terminal manufacturer shall provide a Class II 24 VAC transformer and disconnect switch. Actuator shall be direct connection shaft mount type without linkage. All controls shall be installed in approved NEMA type sheet metal enclosure by terminal manufacturer.
7. Box controllers with self calibration shall not interrupt flow.

J. Control Sequence: See Drawings for control sequences.

2.3 CASING LINER

- A. Casing Liner, Flexible Elastomeric: Flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Minimum Thickness: 3/4 inch.
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A.

2.4 LABORATORY CONTROL SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide laboratory control system by Antec Controls or comparable product by one of the following:
1. Antec Controls (Price)
 2. Automated Logic Corporation
 3. Johnson Controls, Inc.
 4. Phoenix Controls
 5. Siemens Building Technologies, Inc.
 6. Trane
 7. In accordance with this specification, alternative laboratory airflow control systems and equipment shall be considered for approval provided that the equipment be equal to the operational characteristics, capacities, and intent of control sequences specified herein. Approval to bid does not relieve the laboratory airflow control system supplier from complying with the minimum requirements or intent of this specification.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. The Laboratory Control System (LCS) shall be fully integrated to the HVAC Instrumentation and Controls System to maintain laboratory room supply and exhaust airflows, room ventilation rates, room static pressurization, room ambient temperatures & humidity's and the laboratory exhaust system functionality as specified herein.
- C. The LCS shall include all laboratory room supply valves, reheat coils, air terminal actuators, sensors, associated instrumentation and the control units and associated interconnecting wiring and pneumatic tubing. Any and all associated components required to implement a fully functioning and integrated system as specified herein shall also be provided. System verification and other documentation as specified under the Sections referenced herein shall also be included.
- D. All LCS data shall be capable of being accessed by authorized persons via the facility HVAC control system to obtain LCS data in graphical form as well as in specific user defined and configured LCS summary and status reports.
- E. Methods of integration shall be as defined elsewhere in this Section.
- F. Use new products that the manufacturer is currently manufacturing and that have been installed in similar installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner or Owner's representative. Spare parts shall be available for at least five years after completion of this contract.
- G. Laboratory Controllers
 - 1. CAV/2-State Auxiliary Exhaust Device Controllers
 - a. Provide a UL 916 listed controller where shown on drawings for constant volume-2 state (CV2) auxiliary exhaust devices (i.e., canopy hoods, snorkels etc). Exhaust air shall be controlled at two individual setpoints corresponding to switch/software command as indicated in Part 3, Sequence of Controls. The exhaust control process shall maintain exhaust at its respective setpoint in response to actual exhaust airflow measurement to ensure full pressure independent closed loop control using a proportional, integral and derivative (PID) control algorithm.
 - b. Controller shall be capable of receiving status override functions as defined in sequence of operations.
 - c. The controller shall provide a continuous hardwired flow signal to the Lab Room Controller indicating exhaust airflow to ensure stand-alone flow tracking. If the control function is directly connected to the Lab Room Controller, a dedicated controller is not required.
 - d. Provide an Operator Display Panel (ODP) located at the designated height near the exhaust device(s). The ODP will provide the following functions.
 - 1) Provide the switchover function for two-state control (i.e., occupied/unoccupied, on/off etc).
 - 2) Provide audible/visual alarm indication for exhaust airflow.
 - 3) Provide a silence switch.
 - 4) Provide an operator interface to the controller.
 - 2. VAV/CAV General Lab Room Controllers
 - a. Laboratory room controllers shall provide closed loop pressure independent control of all laboratory room ventilation and ambient requirements. The laboratory room controller shall continuously monitor all

the supply and auxiliary exhaust airflow devices including VAV fume hoods in the room.

- b. Pressure control algorithm shall control supply and exhaust airflow devices in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. The offset shall be field adjustable and represents the volume of air which will enter (or exit) the room from the corridor or adjacent spaces
- c. Unless specifically indicated within the sequence of operation, volumetric offset shall be the only acceptable means of controlling room pressurization. Systems that rely on differential pressure as a means of control shall provide documentation that space pressurization can be maintained if fume hood sashes are changed at the same time a door to the space is opened.
- d. Room ambient control (temperature, humidity etc.) and any other room control functions (lighting, IAQ etc.) shall be maintained by the controller as indicated in the sequence of operations.
- e. All laboratory room controllers shall include all inputs and control outputs necessary to perform the specified control sequences. Each laboratory room controller shall operate as a standalone unit, performing its specified control responsibilities independently. All input point and control output point databases as well as the control programs shall be stored in non-volatile EEPROM, EPROM and PROM memory, or a minimum of 100-hour battery backup shall be provided.
- f. Momentary or extended losses of power shall not change or affect any laboratory room controller setpoints or stored data. Upon resumption of power the controller shall resume full normal operation exactly as before without any need for manual intervention. Upon a power failure or operational failure within the controller, the air terminal shall automatically be positioned to the predetermined fully open or fully closed (failsafe) position as indicated on the air terminal schedules in the project plans.
- g. All laboratory room controllers shall include the ability to accept a minimum of two dry contact closure inputs from an auxiliary source into the room control sequence for such purposes as occupied/unoccupied ventilation changeover, emergency mode sequences, etc.
- h. All laboratory room controllers shall provide a general alarm output that may be used for auxiliary signaling or notification.

H. Laboratory VAV/CAV Air Terminals

- 1. Single Blade Damper - Closed Loop Control
 - a. Provide industrial grade Terminal Units with construction, leakage, and performance as stated within. Commercial grade terminal units are not acceptable. Units not conforming to all construction and performance criteria listed herein will be rejected.
 - b. Laboratory Terminals shall have a single blade damper for airflow adjustment and shall provide the individual airflow capacities indicated in the project airflow schedules. Terminal airflow shall be pressure independently controlled using actual independent airflow measurement feedback as an integral part of a closed loop control process.
 - c. Minimum airflow sensor measurement accuracy shall be +/- 5% of actual airflow over the entire design airflow range of each air terminal. Airflow

- measurement accuracy substantiation by a qualified independent test agency shall be available upon request.
- d. Airflow transmitter shall be factory mounted on the terminal and shall include the necessary signal conditioning/transmitter instrumentation to provide an output proportional to the velocity pressure. Transmitter shall have an accuracy of at least +/- 0.5% of the transmitter range and a drift no greater than 0.5% full scale/year. Transmitter ranges shall not exceed 0 to 1.00 Inches W.C. High and low limits shall be fully adjustable. Transmitters not meeting the drift requirements shall be provided with an auto-zero solenoid that connects to the air velocity pressure transducer's inlet ports for enabling automatic periodic re-calibration to ensure drift-free airflow measurement. Automatic re-calibration shall occur at a minimum every 24 hours without airflow disruption to the space.
 - e. All single blade damper air terminals shall have a wide open pressure drop less than 0.25" wc at airflow equivalent to 2000 fpm inlet duct velocity.
 - f. Room supply air terminals shall be industrial grade and constructed of 22 gauge galvanized steel with mechanically locked and gasketed seams and shall meet the mechanical standards of and be in compliance with UL 181 and UL 723, NFPA 90A, ESTM E84 and bacteria standard ASTM C665. Air terminal casings shall have 3/4" thick fiber-free closed cell foam insulation. Damper shafts shall be solid 1/2" diameter zinc-plated steel with self-lubricating polyethylene bushings and with external indication of the damper position. Damper blades shall be 22 gauge steel with a polyurethane foam gasket to enable tight shutoff for smoke control applications. Air terminal leakage shall not exceed 1% @ 6 inches W.C. positive static pressure of the airflow corresponding to 2000 fpm inlet duct velocity. Dampers 16" diameter and less shall be capable of a total shut off of room supply airflow (leakage to be less than 1% of airflow corresponding to 2000 fpm inlet duct velocity). Supply air terminals shall be provided with an averaging pitot tube array type of airflow sensor located upstream from all other air terminal components. Supply terminals shall be provided with integral hot water reheat coils comprised of copper tubing of 0.017" wall thickness and have heavy gauge sine wave coil fins for efficient heat transfer meeting scheduled capacities. The supply terminals shall be certified under ARI-880, and display the ARI label.
 - g. Room general exhaust air terminals including the damper blades shall be industrial grade and constructed of minimum 22 gauge galvanized steel. Damper shafts shall be 1/2" diameter zinc-plated steel with self-lubricating Teflon bushings and with external indication of the damper position. Terminal air leakage shall not exceed 1% of design airflow @ 6 inches W.C. positive static pressure. Room general exhaust air terminals shall be provided with an orifice ring type of airflow sensor located upstream of the damper.
 - h. All fume hood exhaust terminals shall be constructed of minimum 20 gauge, Type 304 or 316 stainless steel, with all materials exposed to the airstream provided with a baked on Phenolic, PTFE or PFA coating. Damper shafts shall be 1/2" diameter coated stainless steel with self-lubricating Teflon bushings and with external indication of the damper position. Fume hood exhaust terminals shall be provided with an orifice ring type of airflow sensor located upstream of the damper. Airflow sensing techniques that are likely to become inoperative due to accumulation of

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

particulate or chemical deposits or which can catch debris and obstruct exhaust airflow shall not be acceptable for fume hood exhaust applications. Unacceptable airflow measurement sensors for fume hood exhaust air terminals include pitot tubes, vortex shedders, thermal anemometers and other devices that protrude into the center of the exhaust air stream.

- i. Discharge and radiated sound power level data shall be provided for each different size and type of air terminal as part of the submittal documentation. Sound power data shall be obtained in accordance with ANSI/ASHRAE 130-1995 Standard Methods of Testing for Rating Ducted Air Terminal Units. All sound data shall be obtained by a qualified, accredited and ARI approved testing laboratory.

I. Airflow Control Sound Specifications:

1. Unless otherwise specified the airflow control device shall not exceed the sound power levels in Table 1, Table 2, or Table 3.
2. If the airflow control device cannot meet the sound power level specification, a properly sized silencer or sound attenuator must be used. All silencers must be of a packless design (constructed of at least 18 gauge 316L stainless steel when used with fume hood exhaust) with a maximum pressure drop at the device's maximum rated flow rate not to exceed 0.20 inches of water.
3. All proposed airflow control devices shall include discharge, exhaust, and radiated sound power level performance.
4. Table 1. Exhaust Airflow Control Device Sound Power Level (Airborne).

	Exhaust Sound Power Level in dB (re: 10⁻¹² watts)					
Octave Band Number	2	3	4	5	6	7
Center Frequency in Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1000-50 cfm Device						
800 cfm @ 0.6" wc	63	55	52	54	50	49
200 cfm @ 0.6" wc	46	42	38	37	32	25
800 cfm @ 3.0" wc	73	70	64	66	65	60
200 cfm @ 3.0" wc	51	52	51	50	52	51
1500-100 cfm Device						
1200 cfm @ 0.6" wc	65	58	53	56	52	52
400 cfm @ 0.6" wc	50	45	38	39	37	31
1200 cfm @ 3.0" wc	72	70	62	65	64	60
400 cfm @ 3.0" wc	55	57	55	53	56	55
3000-200 cfm Device						
2400 cfm @ 0.6" wc	63	56	55	58	54	55
800 cfm @ 0.6" wc	51	45	41	42	39	34

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2400 cfm @ 3.0" wc	74	71	65	69	67	63
800 cfm @ 3.0" wc	58	58	56	56	59	58

5. Table 2. Supply Airflow Control Device Sound Power Level (Airborne)

	Discharge Sound Power Level in dB (re: 10 ⁻¹² watts)					
Octave Band Number	2	3	4	5	6	7
Center Frequency in Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1000-50 cfm Device						
800 cfm @ 0.6" wc	62	57	54	58	54	51
200 cfm @ 0.6" wc	45	46	42	44	40	34
800 cfm @ 3.0" wc	72	71	67	75	72	68
200 cfm @ 3.0" wc	53	56	54	58	56	54
1500-100 cfm Device						
1200 cfm @ 0.6" wc	63	59	55	60	54	53
400 cfm @ 0.6" wc	53	49	44	49	45	39
1200 cfm @ 3.0" wc	72	73	69	77	72	68
400 cfm @ 3.0" wc	58	63	61	63	60	57
3000-200 cfm Device						
2400 cfm @ 0.6" wc	64	60	58	63	56	56
800 cfm @ 0.6" wc	52	48	47	52	46	41
2400 cfm @ 3.0" wc	75	75	72	78	73	70
800 cfm @ 3.0" wc	59	62	62	66	62	60

6. Table 3. Supply Airflow Control Device Sound Power Level (Radiated)

	Radiated Sound Power Level in dB (re: 10 ⁻¹² watts)					
Octave Band Number	2	3	4	5	6	7
Center Frequency in Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1000-50 cfm Device						
800 cfm @ 0.6" wc	44	41	45	41	36	34
200 cfm @ 0.6" wc	33	28	31	29	26	20
800 cfm @ 3.0" wc	53	53	56	57	55	53

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

200 cfm @ 3.0" wc	41	38	41	39	39	37
1500-100 cfm Device						
1200 cfm @ 0.6" wc	47	53	40	42	38	36
400 cfm @ 0.6" wc	35	39	31	34	33	26
1200 cfm @ 3.0" wc	52	60	54	60	59	53
400 cfm @ 3.0" wc	42	44	43	46	46	42
3000-200 cfm Device						
2400 cfm @ 0.6" wc	58	56	45	47	43	42
800 cfm @ 0.6" wc	45	43	36	39	37	29
2400 cfm @ 3.0" wc	69	68	60	65	63	57
800 cfm @ 3.0" wc	54	53	48	51	50	48

J. Laboratory Terminal Unit Electric Actuators

1. General: Provide high-speed electronic actuators for all supply and exhaust type terminals serving spaces with VAV fume hoods. All other terminals shall be provided with standard electronic actuators as specified herein. All actuators shall be factory mounted on terminals.
2. For high-speed actuators, the flow response time from 0 to 90% flow shall be no greater than 1 second under normal conditions when used with either a terminal box single blade damper or venturi air valve.
3. All actuators shall be provided with a manual override feature allowing the end user to stroke the damper to either the full open or full closed position. Actuators shall be capable of either floating control or analog (0-10Vdc, 4-20mA) control, as needed by the Laboratory application.
4. Fail-safe position shall be as indicated in sequence of operation/control drawings specified herein. Failure mode shall be field selectable via dipswitches.

K. Occupancy Sensor

1. Occupancy sensors shall use a combination Passive Infrared (PIR) and Microwave technology with continuous monitoring and built-in diagnostics. Ceiling mounted units shall have 360 deg field-of-view.
2. Basis of design: IntelliSense DT-6360STC

L. Sensors and Binary Devices: As specified elsewhere under this Section.

M. Miscellaneous control devices: All other control devices not specifically identified under Laboratory Control System shall meet specific item requirements listed elsewhere under this Section.

N. Reheat Coils: Laboratory supply terminal units shall be provided with a SCR controlled electric reheat coil. The control of the reheat coil shall be in conjunction with the terminal unit control. The terminal unit controller shall be responsible for the control of the reheat coil.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- O. Installation: The automatic temperature controls (ATC) contractor shall install the interface boxes, presence and motion sensor, and fume hood monitor on the fume hood under initial supervision of the laboratory airflow control system supplier.
 - 1. The ATC contractor shall install the laboratory control unit (if panel-mounted) and wall-mounted power supply (as required) in an accessible location in the designated laboratory room.
 - 2. The ATC contractor shall terminate and connect all cables as required. In addition, integrated laboratory control unit connectors shall be furnished by the ATC.
 - 3. The mechanical contractor shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages.
 - 4. The mechanical contractor shall provide and install all reheat coils and transitions.
 - 5. The mechanical contractor shall provide and install insulation as required.
 - 6. The Division 26 Contractor (Electrical Contractor) shall provide 120 volt power in the laboratory ceiling spaces for connection to the laboratory control system equipment or where indicated on Division 26 drawings. It shall be the responsibility of this contractor to provide 24 VAC power where required by the LACS and associated control devices.
 - 7. Air Terminals, Reheat Coils
 - a. LACS contractor shall furnish all laboratory air terminal and reheat coils (if separate from the air terminal) to the Div 23 contractor for installation. Div 23 contractor shall provide necessary ductwork/piping transitions as required for mounting equipment furnished by the LACS contractor
 - b. Actuators shall be mounted on the same side of air terminals as coil connections to ensure service access
 - c. Access door shall be provided at inlet side of coil by the Div 23 contractor.
 - 8. Occupancy sensors
 - a. Install sensors to provide full coverage of the intended space. Coordinate with the Engineer if locations shown on drawings will not provide full coverage prior to installation.
- P. LACS System Checkout and Testing
 - 1. System startup shall be provided by factory certified and trained employees of the LACS manufacturer. 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. Start up shall include the following tasks:
 - a. Determine when the HVAC equipment and each room is ready for ventilation system operational testing.
 - b. Furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
 - c. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
 - d. 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.
 - e. Alarms and Interlocks:
 - 1) Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 2) 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.
 - 3) Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.
 - f. Set up all laboratory room and fume hood controllers and verify that all controlled parameters are being maintained at the required setpoint and that all associated operational aspects including measurement accuracies, alarm criteria, high-low limits, time delays, etc. are functioning in accord with the specified performance. The Testing Adjusting and Balancing (TAB) agent shall verify that all airflows are within the specified requirements and any departure from the specified performance shall be corrected and verified by the LACS to ensure all aspects of the control system are in full conformance with these specifications. The setup and verification process shall cover:
 - 1) Room supply and exhaust airflows and the room ventilation rate control
 - 2) Room static pressurization control and associated operational criteria.
 - 3) Room ambient temperature control
 - 4) Room/zone humidity control
 - 5) Room emergency control sequences
 2. All operational aspects of the LACS performance shall be formally recorded when verified and a copy of the recorded data shall be provided to the owner as part of the as-built documentation.
- Q. Building Automation System Interface
 1. All points shall be provided to and from the BAS.
 2. Information shall be communicated by seamless LAN connections.
- R. LACS System Demonstration and Acceptance
 1. Demonstration
 - a. 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.
 - b. 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.
 - c. The demonstration process shall follow that approved in "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
 - d. The LACS supplier shall provide a functional demonstration on the LACS operation to owner designated representatives as well as other interested participants which may include the architect, engineer, as well as the general and mechanical contractors. This demonstration shall include any LACS control sequences selected by the owners representatives and may cover several laboratory rooms. Demonstration items that may be included

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

(but not limited to) shall include fume hood and room airflow control, room pressurization control, exhaust system functionality, emergency functions and associated local monitoring provisions as well as required BAS monitoring and alarm reporting. The day for this demonstration shall be established by the owner's representatives in conjunction with the other participants.

2. Acceptance
 - a. 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.
 - b. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved.
3. Training
 - a. The LACS contractor shall provide on-site instruction for up to six (6) owner designated personnel covering all aspects of the operation and use of the LACS including operator interface, control parameter setpoint adjustment, alarm limit and time delay adjustments, point trending, automatic startup, shutdown and changeover scheduling as well as the manipulation and utilization of all associated LACS monitoring and control functions. The training shall be augmented with an operational manual for each attendee and shall also include the recommended procedures to verify the proper functioning of the LACS. Instructors shall be highly qualified factory trained personnel who reside at the local branch office of the LACS supplier and who are thoroughly familiar with all aspects of the overall subject matter and this specific facility's LACS. All training shall be provided on weekdays during the normal daytime working hours of the facility operations personnel.
 - b. Training shall consist of not less than 8 hours for designated personnel.
 - c. Additional specialized operational training courses shall be made available to facility personnel covering the LACS and its components.

2.5 SOURCE QUALITY CONTROL

- A. AHRI 880 Certification: Test, rate, and label assembled air terminal units in accordance with AHRI 880.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" and Section 233113 "Metal Ducts" for hangers and supports.
- B. Install air terminal units according to NFPA 90A.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- D. Unless otherwise indicated, air terminal units and associated controls shall be installed at a height no greater than 3 feet above a ceiling to allow maintenance accessibility.

3.2 DUCTWORK CONNECTIONS

- A. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.
- B. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

- A. Install field power to each air terminal unit electrical power connection. Coordinate with air terminal unit manufacturer and installers.
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 IDENTIFICATION

- A. Label each air terminal unit with drawing designation, nominal airflow, maximum and minimum factory-set airflows, and coil type. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - 3. Verify that controls and control enclosure are accessible.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.6 ADJUSTING

- A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air terminal unit testing, adjusting, and balancing.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 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.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 233713 - AIR DEVICES

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. Registers, grilles and diffusers.
- B. Related Requirements:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling 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. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 AIR DEVICES, GENERAL

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:
 - 1. Anemostat Products; a Mestek company
 - 2. Carnes Company
 - 3. Krueger
 - 4. METALAIRE, Inc
 - 5. Nailor Industries Inc
 - 6. Price Industries
 - 7. Titus
 - 8. Tuttle & Bailey
- B. Provide air devices of the minimum sizes and quantities indicated and of the types specified.
- C. Contractor shall carefully study the drawings and the field conditions to ascertain the air device requirements as to suitability, location, air capacity, required accessories, border and finish.
- D. Border types shall be compatible with Architectural ceiling type for the room for which the air device is located. All devices shall have plaster frames when installed in plaster or drywall construction.
- E. Margins shall be as indicated or directed to suit field conditions.
- F. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
- G. Air devices shall be selected to provide draft-free air distribution over entire area served and sound rating shall not exceed Noise Criteria (NC) 25.
- H. Air device finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes.
 - 1. The pencil hardness must be HB to H.
 - 2. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film.
 - 3. The paint must pass a 250-hour ASTM D870 Water Immersion Test.
- I. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

2.2 TYPE A: LOUVERED FACE SUPPLY DIFFUSER, STEEL

- A. Ceiling diffusers shall be TITUS Model TDCA (steel) or approved equal for adjustable discharge pattern. These diffusers shall consist of an outer frame assembly of the sizes and mounting types shown on the plans and outlet schedule.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. A square or rectangular inlet shall be an integral part of the frame assembly and a transition piece shall be available to facilitate attachment of round duct. An inner core assembly consisting of fixed deflection louvers shall be available in one-, two-, three- or four-way horizontal discharge patterns.
- C. Diffuser shall include adjustable vanes to provide full vertical projection as well as horizontal projection. The inner core assembly must be removable in the field without tools for easy installation, cleaning or damper adjustment.
- D. Opposed blade volume damper shall not be provided. Throw Reducing Vanes (TRV) must be available to deflect a horizontal discharge airstream from each side of the TDC diffuser into diverging airstreams.
- E. Molded insulation blanket shall be available. The insulation will be R-6, foil-backed, and provide an additional 1-inch gap around the neck to install insulated flex duct.
- F. The grille finish shall be #26 white.

2.3 TYPE B: LOUVERED FACE SUPPLY DIFFUSER, ALUMINUM

- A. Ceiling diffusers shall be TITUS Model TDCA-AA aluminum louvered face diffuser, adjustable, or approved equal of the sizes and mounting types shown on the plans and outlet schedule.
- B. Diffusers shall consist of an outer frame assembly suitable for modular ceiling systems and an inner core assembly arranged to provide one-, two-, three-, or four-way horizontal discharge patterns as scheduled.
- C. Diffusers shall be selected to handle the scheduled air quantity at the indicated pressure drop and noise criteria while maintaining an unbroken horizontal airflow pattern from maximum airflow down to minimum airflow.
- D. Core assembly shall be removable in the field without tools for installation, cleaning, and access to accessories. Provide neck size, border type, and mounting configuration as indicated on the drawings and air device schedule.
- E. Opposed blade volume damper shall not be provided unless indicated on the drawings or air device schedule.
- F. The grille finish shall be #26 white.

2.4 TYPE C: PERFORATED RETURN GRILLE, STEEL

- A. Perforated ceiling diffusers shall be TITUS model PAR (steel, flush face) or approved equal for return of the sizes and mounting types shown on the plans and outlet schedule.
- B. Diffusers shall have a perforated face with 3/16-inch diameter holes on ¼-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel. The backpan shall be one piece stamped heavy gauge steel of the sizes and

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

mounting types shown on the plans and outlet schedule. The diffuser neck shall have 1 1/8-inch depth for easy duct connection.

- C. The perforated face must be easily unlatchable from the backpan.
- D. Optional opposed blade volume damper shall not be provided.
- E. The grille finish shall be #26 white.

2.5 TYPE D: RETURN GRILLE, STEEL

- A. Steel return grilles shall be TITUS Model 350R (3/4-inch blade spacing) or approved equal of the sizes and mounting types shown on the plans and outlet schedule.
- B. The fixed deflection blades shall be available parallel to the long dimension of the grille. Construction shall be of steel with a 1 1/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.
- C. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.
- D. Optional opposed blade volume damper shall not be provided.
- E. The grille finish shall be #26 white.

2.6 TYPE E: AEROBLADE SINGLE-DEFLECTION EXHAUST GRILLE

- A. Exhaust grilles shall be TITUS AeroBlade Model 271, aluminum construction as scheduled, or approved equal, of the sizes and mounting types shown on the plans and outlet schedule.
- B. Grilles shall be single-deflection type with 3/4-inch blade spacing and individually adjustable aerodynamically shaped airfoil blades. Blade orientation shall be parallel to the long or short dimension as scheduled.
- C. Grilles shall be suitable for commercial air distribution applications and selected to minimize pressure loss and noise levels while providing the indicated airflow pattern.
- D. Opposed blade volume damper shall not be provided.
- E. The grille finish shall be #26 white.

PART 3 - EXECUTION

3.1 EXAMINATION

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install air devices level and plumb.
- B. Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install air devices with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Paint the ductwork behind registers with flat black enamel so that bright surface cannot be seen. Properly prime galvanized surface prior to painting.

3.3 ADJUSTING

- A. After installation, adjust air devices to air patterns indicated, or as directed, before starting air balancing.
- B. The position of the pattern controllers for linear supply diffusers shall be verified and adjusted during Testing, Adjusting and Balancing.

END OF SECTION 233713

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 237416.13 - PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged, large-capacity, rooftop air-conditioning units.

B. Related Requirements:

1. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components.

1.2 ACTION SUBMITTALS

A. Product Data: For each unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:
 - a. Include certified fan-performance curves with system operating conditions indicated.
 - b. Include certified fan-sound power ratings.
 - c. Include fan construction and accessories.
 - d. Include motor ratings, electrical characteristics, and motor accessories.
6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include gas furnaces with performance characteristics.
9. Include factory selection calculations for each antimicrobial UV lamp installation.
10. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each Unit.

1. Include plans, elevations, sections, and [mounting][attachment] details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Delegated Design Submittals: For Unit supports, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- 1. Restraint Details: Wind-and seismic- detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Seismic Qualification Data: Certificates, for Units, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Restraint of internal components.
- C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in Section 230548 "Vibration and Seismic Controls for HVAC" and Section 018123 "Facility Seismic and Wind Criteria."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Source quality control reports.
- E. System startup reports.
- F. Field quality control reports.
- G. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For Units.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials described below that match products in-

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

stalled and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.
2. Gaskets: One set(s) for each access door.

1.6 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of Unit that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Manufacturer's standard warranty, but not less than one year parts only from date of Substantial Completion.
 2. Warranty Period for Digital, Variable-Speed, and Standard Scroll Compressors: Manufacturer's standard warranty, but not less than five years from date of Substantial Completion.
 3. Warranty Period for Heat Exchanger: Manufacturer's standard warranty, but not less than 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TRANE HORIZON OUTDOOR AIR UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Trane Horizon Outdoor Air Unit, Revision 6, or comparable product by one of the following:
 1. Carrier
 2. JCI/York
 3. Trane
- B. Casing: Zinc-coated, heavy-gauge galvanized steel casing with weather-resistant baked enamel finish tested in accordance with ASTM B117; 2-inch double-wall construction with antimicrobial rigid polyurethane foam insulation, metal encapsulated with no exposed edges; base pan without penetrations within the curb perimeter except raised supply and return openings; one-piece or double-hemmed, gasket-sealed top; and stainless steel double-sloped condensate drain pan with through-wall condensate drain connection.
- C. Factory sensors: Provide combination outdoor-air temperature and relative-humidity sensor in outdoor-air hood and supply-air temperature sensing tube or sensor downstream of indoor fan section.
- D. Filters: Factory filter arrangement with intake aluminum mesh filters or galvanized mesh bird screen as applicable, MERV 8 prefilters, MERV 13 final filters, and filter rack upstream of evaporator coil.
- E. Dampers and outdoor-air monitoring: Provide outdoor-air, return-air, economizer, exhaust, and isolation dampers and airflow probes where scheduled on Drawings. Outdoor-air monitoring shall include factory-calibrated airflow and temperature probes with microprocessor transmitter/controller, programmable airflow measurement and

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

alarm functions, selectable analog output signals, LCD display, and field calibration capability.

- F. Controls and accessories: Factory controls with Symbio 500 controller hardware template, TD7 display where scheduled, supply discharge air sensor furnished by manufacturer for field installation, condensate overflow switch, non-fused disconnect circuit breaker, supply fan piezo ring or supply and exhaust fan piezo rings as scheduled, hail guards, factory-provided voltage/phase monitor, and phase unbalance, over/under voltage, brownout, phase loss, and phase reversal protection.
- G. Heating and reheat components: Provide indirect-fired natural gas heat and modulating hot-gas reheat where scheduled on Drawings. Gas heating section shall include stainless steel burners, Type 439 stainless steel heat exchanger tubes, induced draft combustion blower, direct spark ignition system with pre-purge, lockout after three unsuccessful ignition attempts, low-NOx compliance, natural gas suitability, and factory-provided heat exchanger warranty.
- H. Refrigerant system: Factory DX cooling using R-454B low-GWP refrigerant with digital scroll compressor capable of modulation from 20 to 100 percent, crankcase heaters, air-cooled fin-and-tube outdoor coil, DX four-row indoor coil, active low-ambient head-pressure control, and ETL-listed unit construction classified in accordance with UL 60335-2-40/CSA C22.2 No. 60335-2-40 for central cooling air conditioners.
- I. Corrosive environment package: Provide Eco coated coils where scheduled on Drawings. Coil coating shall be flexible epoxy polymer e-coat with polyurethane topcoat, applied to encapsulate coil surfaces without material bridging between fins, and shall meet ASTM B117 salt spray, ASTM G85-A3 SWAAT corrosion, ASTM D3359 cross-hatch adhesion, and ASTM D2794 impact-resistance requirements.
- J. Hail guards: Provide removable perforated-metal hail guards installed outside condenser coils, same gauge and color as unit casing, configured to avoid restricting airflow and removable for coil cleaning.
- K. Submitted options and accessories shall be provided where indicated in the Contract Documents. Contractor shall coordinate unit airflow configuration, outdoor-air and return-air damper arrangement, economizer, exhaust isolation dampers, modulating hot-gas reheat, indirect-fired natural gas heat, factory standalone unit controls, factory airflow probes, TD7 display, supply discharge-air sensor, condensate overflow switch, supply and exhaust fan piezo rings, non-fused disconnect circuit breaker, active low-ambient head-pressure control, MERV 8 prefilters, MERV 13 final filters, Eco coated coils, and hail guards with the equipment schedules, schematic diagrams, and controls diagrams shown on the Drawings.
- L. Standalone Unit Controls and Sequence
 1. Units shall operate as standalone packaged outdoor-air units using factory-furnished unit controls. Do not provide connection to a building automation system unless specifically indicated on the Drawings.
 2. Contractor shall coordinate unit operating modes, enable signals, occupancy schedules, temperature setpoints, airflow control, damper positions, heating operation, cooling operation, dehumidification operation, hot-gas reheat operation, exhaust fan operation, safety shutdowns, and alarm functions with the

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

equipment schedules, schematic diagrams, and controls diagrams shown on the Drawings.

3. Factory controller shall use factory-furnished and field-installed sensors, including outdoor-air temperature and relative humidity sensor, supply-air temperature sensor, airflow probes, condensate overflow switch, unit safeties, and fan piezo-ring airflow measurement devices where scheduled, to perform unit control and protection functions.
4. Provide local operator interface at the unit where scheduled to allow authorized adjustment, diagnostics, status review, and alarm review without reliance on remote BAS interface.
5. Coordinate factory startup and checkout to verify standalone control operation, including fan operation, damper operation, heating and cooling staging or modulation, hot-gas reheat where scheduled, exhaust fan operation where scheduled, safeties, alarms, and shutdown functions.

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 outdoor air units.
- B. Examine roughing-in for outdoor air units to verify actual locations of piping, duct, electrical, and control connections before equipment installation.
- C. Examine concrete equipment pads for suitable conditions where outdoor air units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PACKAGED, LARGE-CAPACITY, OUTDOOR AIR UNITS

- A. Equipment Mounting: Install Units level on grade-mounted cast-in-place concrete equipment pads. Coordinate pad dimensions, pad elevations, anchor locations, unit service clearances, duct connections, condensate drain routing, electrical connections, control wiring, and manufacturer-required access clearances with the equipment schedules, schematic diagrams, controls diagrams, structural drawings, and manufacturer's written installation instructions. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete." Secure Units to concrete pads with anchor bolts in accordance with manufacturer's written instructions and applicable wind and seismic restraint requirements.
 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.3 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing condensate drain piping adjacent to Unit, allow space for service and maintenance.
- C. Connect condensate drain piping to Unit in accordance with manufacturer's written instructions.
- D. Connect condensate drain pans with trapped condensate drain piping. Extend condensate drain piping to approved discharge location indicated on Drawings. Provide cleanouts at changes in direction and provide freeze protection where piping is exposed to freezing conditions.

3.4 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Connect supply, return, outdoor-air, and exhaust ducts to Units with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Coordinate connection locations with the Drawings and manufacturer's written installation instructions.

3.5 ELECTRICAL CONNECTIONS

- A. Connect electrical wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate is to be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate is to be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
 - 3. Locate nameplate where easily visible.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.6 CONTROL CONNECTIONS

- A. Install control wiring to unit-mounted and field-mounted control devices required for standalone unit operation and sequences indicated on the Drawings.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables" and manufacturer's written instructions.

3.7 CLEANING

- A. After completing system installation and testing, adjusting, and balancing Units and air-distribution systems, clean Units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Inspect for visible damage to unit casing.
 - 3. Inspect for visible damage to furnace combustion chamber.
 - 4. Inspect for visible damage to compressor, coils, and fans.
 - 5. Inspect internal insulation.
 - 6. Verify that labels are clearly visible.
 - 7. Verify that clearances have been provided for servicing.
 - 8. Verify that controls are connected and operable.
 - 9. Verify that filters are installed.
 - 10. Clean all coils and inspect for construction debris.
 - 11. Clean furnace flue and inspect for construction debris.
 - 12. Connect and purge gas line.
 - 13. Remove packing from vibration isolators.
 - 14. Inspect operation of barometric relief dampers.
 - 15. Verify lubrication on fan and motor bearings.
 - 16. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 17. Start unit in accordance with 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.
 - 18. Inspect and record performance of interlocks and protective devices; verify sequences of operation.
 - 19. Operate unit for an initial period as recommended or required by manufacturer.
 - 20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. 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.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. 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.
27. 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.
28. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.9 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
- C. Occupancy Adjustments: When requested within [12]<Insert number> months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [two]<Insert number> visits to Project during

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

other-than-normal occupancy hours for this purpose.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: [Owner will engage][Engage] a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections [with the assistance of a factory-authorized service representative]:
 - 1. After installing Units 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.
 - 5. Unit will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Units.

END OF SECTION 237416.13

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - SUMMARY

A. Section Includes:

1. Split-system air-conditioners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. 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. Include detail of 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.

D. Sustainable Design Submittals:

1. Refrigerant: Product Data for refrigerants, indicating compliance with refrigerant management practices.
2. Product Data: For energy performance.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.5 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: One set(s) for each air-handling unit.
 - 2. Gaskets: One set(s) for each access door.

1.6 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.
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of concrete housekeeping pads with actual equipment provided. Do not provide roof curbs, roof-mounted supports, wall brackets, or roof penetrations for outdoor condensing units unless specifically indicated otherwise.

1.8 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: [One][Five]<Insert number> year(s) from date of Substantial Completion.
 - b. For Parts: [One][Five]<Insert number> year(s) from date of Substantial Completion.
 - c. For Labor: [One][Five]<Insert number> year(s) from date of Substantial Completion.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM FAN COIL UNIT (FCU-1/SSCU-1)

- A. Basis of Design:
 - 1. Trane / Mitsubishi Electric Trane (METUS) TPKA and TRUY/TRUZ Series.
 - 2. Daikin.
 - 3. LG.
 - 4. Samsung.
- B. SYSTEM DESCRIPTION
 - 1. Factory-matched inverter-driven split-system air-conditioning or heat pump system.
 - 2. Refrigerant:
 - a. R-454B or manufacturer's current standard refrigerant complying with applicable regulations.
 - 3. System shall include:
 - 4. Variable-speed inverter compressor.
 - 5. Electronic expansion valve.
 - 6. Microprocessor controls.
 - 7. Refrigerant leak detection and protective shutdown functions where required by code.
 - 8. Automatic restart after power interruption.
- C. INDOOR UNIT
 - 1. Wall-Mounted Unit
 - 2. Cabinet:
 - a. White molded cabinet suitable for exposed indoor installation.
 - 3. Washable return-air filter.
 - 4. Removable access panels.
 - 5. Fan Assembly:
 - 6. Direct-drive cross-flow blower.
 - 7. Minimum three-speed operation plus auto mode.
 - 8. Coil:
 - a. Direct-expansion evaporator coil.
 - b. Aluminum fins mechanically bonded to copper tubing.
 - 9. Controls:
 - a. Wireless infrared remote controller.
 - b. Capability for wired wall controller.
 - c. Occupied/unoccupied scheduling.
 - d. Automatic fan operation.
 - e. Cooling, heating, dry, fan-only, and auto modes as applicable.
 - 10. Sound Levels:
 - a. Minimum available sound level not greater than manufacturer's published ratings.
- D. OUTDOOR UNIT
 - 1. Cooling Only Unit
 - 2. Cabinet:
 - a. Galvanized steel construction.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Factory-applied corrosion-resistant finish.
- 3. Compressor:
 - a. Variable-speed inverter-driven scroll or rotary compressor as provided by manufacturer.
 - b. Factory-mounted vibration isolation.
- 4. Condenser Coil:
 - a. Copper tube/aluminum fin construction.
 - b. Factory corrosion protection coating where scheduled.
- 5. Fan:
 - a. Direct-drive variable-speed condenser fan.
- 6. Operating Characteristics:
 - a. Low ambient cooling capability.
 - b. Automatic defrost operation for heat pump units.
 - c. High-pressure and low-pressure protection.
 - d. Short-cycle protection.
- 7. Electrical:
 - a. Factory-installed control transformer and controls.

E. CONTROLS

- 1. Manufacturer's factory controls shall provide:
 - a. Space temperature control.
 - b. Heating/cooling changeover.
 - c. Fan-speed control.
 - d. Auto restart.
 - e. Self-diagnostics.
 - f. Fault indication.
- 2. Provide interface capability for:
 - a. Manufacturer's cloud-based monitoring platform.
 - b. Building management system integration.

F. REFRIGERANT PIPING ACCESSORIES

- 1. Refrigerant piping accessories shall be furnished by the equipment manufacturer or approved for use with the system.
- 2. Accessories:
 - a. Insulated suction line.
 - b. Refrigerant line insulation UV protected on exterior runs.
 - c. Line-hide cover system where exposed outdoors.
 - d. Condensate pump where required.
 - e. Isolation pads for outdoor units.

2.2 REFRIGERATION SPLIT SYSTEM UNIT COOLER AND CONDENSING UNIT (FCU-2/CU-1)

A. Basis of Design:

- 1. Manufacturers: Subject to compliance with requirements, **provide products by one of the following:**
 - a. Heatcraft Refrigeration Products / Bohn ADT low-profile unit cooler with BZT air-cooled condensing unit.
 - b. Russell.
 - c. KeepRite Refrigeration.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

B. SYSTEM DESCRIPTION:

1. Factory-matched refrigeration system consisting of indoor unit cooler, remote air-cooled condensing unit, refrigerant piping, controls, and accessories. Select system for scheduled cooling capacity, room temperature, ambient design conditions, and refrigerant indicated on Drawings.

C. UNIT COOLER:

1. Low-profile, ceiling-mounted evaporator unit suitable for walk-in cooler or refrigerated space application. Provide air defrost for medium-temperature applications, factory-mounted direct-drive fan motors, copper-tube/aluminum-fin evaporator coil, drain pan, expansion valve, distributor, and required factory wiring.

D. CONDENSING UNIT:

1. Air-cooled condensing unit with hermetic reciprocating or scroll compressor, condenser coil, condenser fan, receiver where required, service valves, filter drier, sight glass, pressure controls, compressor contactor, overload protection, and weather-resistant cabinet suitable for outdoor installation.

E. CONTROLS:

1. Provide factory or field-mounted electronic refrigeration controller suitable for maintaining space temperature, controlling defrost cycle, monitoring evaporator fans, compressor operation, and alarms. Coordinate controller power, sensors, and alarm contacts with electrical and controls requirements.

F. ACCESSORIES:

1. Provide refrigerant piping specialties, insulation, vibration isolation, condensate drain piping, unit supports, low-ambient controls where required, crankcase heater where required, and weatherproof disconnect or electrical accessories as indicated on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with:

1. Manufacturer's written instructions.
2. Contract documents.
3. Applicable codes.
4. Install indoor units plumb and level.
5. Install outdoor units grade-mounted on concrete housekeeping pads as indicated.
6. Maintain manufacturer's required service clearances.
7. Install indoor fan coil units and refrigeration unit coolers level, securely supported from building structure, and located to maintain manufacturer-required service access, airflow clearances, air throw, and return-air paths.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

8. Install outdoor condensing units level, grade-mounted on concrete housekeeping pads. Maintain condenser airflow clearances and prevent condenser discharge air recirculation.
9. Coordinate equipment locations, refrigerant piping routes, condensate drainage, controls, power wiring, disconnects, low-voltage wiring, and alarm contacts before installation.

3.2 REFRIGERANT PIPING

- A. Install refrigerant piping in accordance with manufacturer's requirements.
- B. Size refrigerant piping, line sets, traps, risers, accessories, and refrigerant charge in accordance with the equipment manufacturer's published requirements for the actual equipment provided.
- C. Install suction and liquid lines to maintain oil return, avoid liquid slugging, and prevent vibration transmission. Provide traps, inverted traps, risers, and line pitch where required by manufacturer.
- D. Support refrigerant piping independently of equipment. Provide vibration isolation, flexible connections where recommended, and protection for exterior piping, insulation, and line-hide systems exposed to weather or ultraviolet light.
- E. Pressure test system with dry nitrogen.
- F. Evacuate system to 500 microns or less prior to charging.
- G. Charge system in accordance with manufacturer's published procedures.

3.3 CONDENSATE DRAINAGE

- A. Install condensate drains with continuous downward slope.
- B. Insulate condensate piping where condensation may occur.
- C. Provide traps as required by manufacturer.
- D. For refrigeration unit coolers, route evaporator drain pan connections to approved receptor or drain location. Provide drain traps, insulation, cleanouts, heat trace, and freeze protection where required by refrigerated-space temperature, ambient exposure, or manufacturer.

3.4 STARTUP

- A. Factory-authorized representative shall:
 1. Verify installation.
 2. Perform startup.
 3. Check operating pressures and temperatures.
 4. Verify control operation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

5. Verify refrigerant charge, superheat, subcooling, compressor operation, fan operation, defrost operation, condensate drainage, thermostat or controller calibration, protective devices, and alarm outputs applicable to the system furnished.

3.5 DEMONSTRATION

- A. Provide owner training covering:
 1. Operation.
 2. Maintenance requirements.
 3. Controller functions.
 4. Filter cleaning procedures.
 5. For refrigeration systems, demonstrate temperature controller operation, setpoint adjustment, alarm acknowledgement, defrost cycle, coil and condenser cleaning requirements, and required airflow clearances at unit coolers and condensing units.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260010 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements generally applicable to all electrical Work on the Project, including but not limited to Work specified in Divisions 26, 27, and 28.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. 8P8C: An 8-position 8-contact modular jack.
2. A: Ampere, unit of electrical current.
3. AC or ac: Alternating current.
4. AFCI: Arc-fault circuit interrupter.
5. AIC: Ampere interrupting capacity.
6. AL, Al, or ALUM: Aluminum.
7. ASD: Adjustable-speed drive.
8. ATS: Automatic transfer switch.
9. AWG: American wire gauge; see ASTM B258.
10. BAS: Building automation system.
11. BIL: Basic impulse insulation level.
12. BIM: Building information modeling.
13. BMS: Building management system.
14. CAD: Computer-aided design or drafting.
15. CATV: Community antenna television.
16. CB: Circuit breaker.
17. cd: Candela, the SI fundamental unit of luminous intensity.
18. CO/ALR: Copper-aluminum, revised.
19. COPS: Critical operations power system.
20. CU or Cu: Copper.
21. CU-AL or AL-CU: Copper-aluminum.
22. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
23. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
24. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
25. dBm: Decibel absolute power with respect to 1 mW.
26. DC or dc: Direct current.
27. DCOA: Designated critical operations area.
28. DDC: Direct digital control (HVAC).
29. EGC: Equipment grounding conductor.
30. ELV: Extra-low voltage.
31. EMF: Electromotive force.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 32. EMI: Electromagnetic interference.
- 33. EMP: Electrical maintenance program (operation and maintenance); electromagnetic pulse (transient analysis).
- 34. EPS: Emergency power supply.
- 35. EPSS: Emergency power supply system.
- 36. ESS: Energy storage system.
- 37. EV: Electric vehicle.
- 38. EVPE: Electric vehicle power export equipment.
- 39. EVSE: Electric vehicle supply equipment.
- 40. FACU: Fire-alarm control unit.
- 41. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion 1 fc = 10 lx in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.
- 42. FLC: Full-load current.
- 43. ft: Foot.
- 44. ft-cd: Foot-candle, the antiquated U.S. standard unit of illuminance, equal to one international candle measured at a distance of one foot, that was superseded in 1948 by the unit "footcandle" when the SI unit candela (cd) replaced the international candle; see "fc."
- 45. FTP: File transfer protocol.
- 46. GEC: Grounding electrode conductor.
- 47. GFCI: Ground-fault circuit interrupter.
- 48. GFPE: Ground-fault protection of equipment.
- 49. GND: Ground.
- 50. HACR: Heating, air conditioning, and refrigeration.
- 51. HDPE: High-density polyethylene.
- 52. HID: High-intensity discharge.
- 53. HP or hp: Horsepower.
- 54. HVAC: Heating, ventilating, and air conditioning.
- 55. Hz: Hertz.
- 56. IBT: Intersystem bonding termination.
- 57. ICT: Information and communications technology.
- 58. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
- 59. I/O: Input/output.
- 60. IP: Ingress protection rating (enclosures); Internet protocol (communications).
- 61. IR: Infrared.
- 62. IS: Intrinsically safe.
- 63. IT&R: Inspecting, testing, and repair.
- 64. ITE: Information technology equipment.
- 65. kAIC: Kiloampere interrupting capacity.
- 66. kcmil or MCM: One thousand circular mils.
- 67. kV: Kilovolt.
- 68. kVA: Kilovolt-ampere.
- 69. kvar: Kilovolt-ampere reactive.
- 70. kW: Kilowatt.
- 71. kWh: Kilowatt-hour.
- 72. LAN: Local area network.
- 73. lb: Pound (weight).
- 74. lbf: Pound (force).

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

75. LCD: Liquid-crystal display.
76. LCDI: Leakage-current detector-interrupter.
77. LED: Light-emitting diode.
78. Li-ion: Lithium-ion.
79. lm: Lumen, the SI-derived unit of luminous flux.
80. LNG: Liquefied natural gas.
81. LP-Gas: Liquefied petroleum gas.
82. LRC: Locked-rotor current.
83. LV: Low voltage.
84. lx: Lux, the SI-derived unit of illuminance equal to one lumen per square meter.
85. m: Meter.
86. MCC: Motor-control center.
87. MDC: Modular data center.
88. MG set: Motor-generator set.
89. MIDI: Musical instrument digital interface.
90. MLO: Main lugs only.
91. MPEG-2: Abbreviation for the ISO/IEC Moving Picture Experts Group's standard for generic coding of moving pictures and associated audio information (ISO/IEC 13818) released in 1995 and used for most over-the-air and satellite broadcast digital television.
92. MPEG-4: Abbreviation for the ISO/IEC Moving Picture Experts Group's standard framework for coding of audio-visual objects (ISO/IEC 14496) released in 1999, with digital rights management and more advanced compression algorithms than MPEG-2.
93. MOV: Metal-oxide varistor.
94. MV: Medium voltage.
95. MVA: Megavolt-ampere.
96. mW: Milliwatt.
97. MW: Megawatt.
98. MWh: Megawatt-hour.
99. N.C.: Normally closed.
100. Ni-Cd: Nickel-cadmium.
101. Ni-MH: Nickel-metal hydride.
102. NIU: Network interface unit.
103. N.O.: Normally open.
104. NPT: National (American) standard pipe taper.
105. OCPD: Overcurrent protective device.
106. ONT: Optical network terminal.
107. PC: Personal computer.
108. PCS: Power conversion system.
109. PCU: Power-conditioning unit.
110. PF or pf: Power factor.
111. PHEV: Plug-in hybrid electric vehicle.
112. PLC: Programmable logic controller.
113. PLFA: Power-limited fire alarm.
114. PoE: Power over Ethernet.
115. POTS: Plain old telephone service. See "public switched telephone network" definition.
116. PSTN: Public switched telephone network.
117. PV: Photovoltaic.
118. PVC: Polyvinyl chloride.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

119. pW: Picowatt.
120. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
121. RMS or rms: Root-mean-square.
122. RPM or rpm: Revolutions per minute.
123. SCADA: Supervisory control and data acquisition.
124. SCCR: Short-circuit current rating.
125. SCR: Silicon-controlled rectifier.
126. SPD: Surge protective device.
127. sq.: Square.
128. SWD: Switching duty.
129. TCP/IP: Transmission Control Protocol/Internet Protocol.
130. TEFC: Totally enclosed fan-cooled.
131. TR: Tamper resistant.
132. TVSS: Transient voltage surge suppressor.
133. UL: (standards) UL Standards & Engagement Inc.; (product categories) UL, LLC.
134. UL CCN: UL Category Control Number.
135. UPS: Uninterruptible power supply.
136. USB: Universal serial bus.
137. UV: Ultraviolet.
138. V: Volt, unit of electromotive force.
139. V(ac): Volt, alternating current.
140. V(dc): Volt, direct current.
141. VA: Volt-ampere, unit of complex electrical power.
142. VAR: Volt-ampere reactive, unit of reactive electrical power.
143. VFC: Variable-frequency controller.
144. VOM: Volt-ohm-multimeter.
145. VoIP: Voice over Internet Protocol.
146. VPN: Virtual private network.
147. VRLA: Valve regulated lead acid; also called "sealed lead acid (SLA)" or "valve regulated sealed lead acid."
148. W: Watt, unit of real electrical power.
149. WAN: Wide area network.
150. Wh: Watt-hour, unit of electrical energy usage.
151. WPT: Wireless power transfer.
152. WPTE: Wireless power transfer equipment.
153. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

1. EMT: Electrical metallic tubing.
2. EMT-A: Aluminum electrical metallic tubing.
3. EMT-S: Steel electrical metallic tubing.
4. EMT-SS: Stainless steel electrical metallic tubing.
5. ENT: Electrical nonmetallic tubing.
6. EPEC: Electrical HDPE underground conduit (thin wall).
7. EPEC-A: Type A electrical HDPE underground conduit.
8. EPEC-B: Type B electrical HDPE underground conduit.
9. ERMC: Electrical rigid metal conduit.
10. ERMC-A: Aluminum electrical rigid metal conduit.
11. ERMC-S: Steel electrical rigid metal conduit.
12. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

13. ERM-C-S-PVC: PVC-coated-steel electrical rigid metal conduit.
14. ERM-C-SS: Stainless steel electrical rigid metal conduit.
15. FMC: Flexible metal conduit.
16. FMC-A: Aluminum flexible metal conduit.
17. FMC-S: Steel flexible metal conduit.
18. FMT: Steel flexible metallic tubing.
19. FNMC: Flexible nonmetallic conduit. See "LFNC."
20. HDPE: HDPE underground conduit (thick wall).
21. HDPE-40: Schedule 40 HDPE underground conduit.
22. HDPE-80: Schedule 80 HDPE underground conduit.
23. IMC: Steel electrical intermediate metal conduit.
24. LFMC: Liquidtight flexible metal conduit.
25. LFMC-A: Aluminum liquidtight flexible metal conduit.
26. LFMC-S: Steel liquidtight flexible metal conduit.
27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
28. LFNC: Liquidtight flexible nonmetallic conduit.
29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
32. PVC: Rigid PVC conduit.
33. PVC-40: Schedule 40 rigid PVC conduit.
34. PVC-80: Schedule 80 rigid PVC Conduit.
35. PVC-A: Type A rigid PVC concrete-encased conduit.
36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
37. RGS: See ERM-C-S-G.
38. RMC: See ERM-C.
39. RTRC: Reinforced thermosetting resin conduit.
40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
44. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.

C. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:

1. AC: Armored cable.
2. CATV: Coaxial general-purpose cable.
3. CATVP: Coaxial plenum cable.
4. CATVR: Coaxial riser cable.
5. CI: Circuit integrity cable.
6. CL2: Class 2 cable.
7. CL2P: Class 2 plenum cable.
8. CL2R: Class 2 riser cable.
9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.
27. ITC: Instrumentation tray cable.
28. ITC-ER: Instrumentation tray cable, exposed run.
29. MC: Metal-clad cable.
30. MC-HL: Metal-clad cable, hazardous location.
31. MI: Mineral-insulated, metal-sheathed cable.
32. MTW: (machine tool wiring) Moisture-, heat-, and oil-resistant thermoplastic cable.
33. MV: Medium-voltage cable.
34. NM: Nonmetallic sheathed cable.
35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
37. NPLF: Non-power-limited fire-alarm circuit cable.
38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
40. NUCC: Nonmetallic underground HDPE conduit with conductors.
41. OFC: Conductive optical fiber general-purpose cable.
42. OFCG: Conductive optical fiber general-purpose cable.
43. OFCP: Conductive optical fiber plenum cable.
44. OFCR: Conductive optical fiber riser cable.
45. OFN: Nonconductive optical fiber general-purpose cable.
46. OFNG: Nonconductive optical fiber general-purpose cable.
47. OFNP: Nonconductive optical fiber plenum cable.
48. OFNR: Nonconductive optical fiber riser cable.
49. P: Marine shipboard cable.
50. PLTC: Power-limited tray cable.
51. PLTC-ER: Power-limited tray cable, exposed run.
52. PV: Photovoltaic cable.
53. RHH: (high heat) Thermoset rubber, heat-resistant cable.
54. RHW: Thermoset rubber, moisture-resistant cable.
55. SA: Silicone rubber cable.
56. SE: Service-entrance cable.
57. SER: Service-entrance cable, round.
58. SEU: Service-entrance cable, flat.
59. SIS: Thermoset cable for switchboard and switchgear wiring.
60. TBS: Thermoplastic cable with outer braid.
61. TC: Tray cable.
62. TC-ER: Tray cable, exposed run.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 63. TC-ER-HL: Tray cable, exposed run, hazardous location.
- 64. THW: Thermoplastic, heat- and moisture-resistant cable.
- 65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
- 66. THHW: Thermoplastic, heat- and moisture-resistant cable.
- 67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
- 68. TW: Thermoplastic, moisture-resistant cable.
- 69. UF: Underground feeder and branch-circuit cable.
- 70. USE: Underground service-entrance cable.
- 71. XHH: Cross-linked polyethylene, heat-resistant cable.
- 72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Abbreviations and Acronyms for Electrical Flexible Cord Types:

- 1. SEO: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
- 2. SEOW: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
- 3. SEOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
- 4. SEOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
- 5. SJEO: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
- 6. SJEOW: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
- 7. SJEOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
- 8. SJEOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
- 9. SJO: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp locations.
- 10. SJOW: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
- 11. SJOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp locations.
- 12. SJOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
- 13. SJTO: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
- 14. SJTOW: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

15. SJTOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
16. SJTOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
17. SO: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp locations.
18. SOW: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
19. SOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp locations.
20. SOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
21. STO: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
22. STOW: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.
23. STOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
24. STOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.

E. Definitions:

1. 8-Position 8-Contact (8P8C) Modular Jack: An unkeyed jack with up to eight contacts commonly used to terminate twisted pair and multiconductor Ethernet cable. Also called a "TIA-1096 miniature 8-position series jack" (8PSJ), or an "IEC 8877 8-pole jack."
 - a. Be careful when suppliers use "RJ45" generically. Obsolete RJ45 jacks used for analog telephone cables have rejection keys. 8P8C jacks used for digital telephone cables and Ethernet cables do not have rejection keys.
2. Basic Impulse Insulation Level (BIL): Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
3. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
4. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
5. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
6. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

7. Conduit: A structure containing one or more duct raceways.
8. Designated Seismic System: An architectural, electrical, or mechanical system and its components for which the component importance factor is greater than 1.0 when determined in accordance with seismic requirements applicable to the Project.
9. Direct Buried: Installed underground without encasement in concrete or other protective material.
10. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.
11. Duct Raceway: A single enclosed raceway for conductors or cable.
12. Electrical Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
13. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
 - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
 - b. Concrete Box: A box intended for use in poured concrete.
 - c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
 - e. Cover Plate: A cover designed for protecting wiring devices installed in flush-mounted device boxes while permitting their safe operation; also called a faceplate or wallplate.
 - f. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
 - g. Device Box: A box with provisions for mounting a wiring device directly to the box.
 - h. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
 - i. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
 - j. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
 - k. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
 - l. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
 - m. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the

- back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
- n. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
 - o. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
 - p. Raised-Floor Box: A floor box intended for use in raised floors.
 - q. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
 - r. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
 - s. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
 - t. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
 - u. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
14. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
15. Essential Electrical Systems: (healthcare facilities) Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system.
16. Fault Limited: Providing or being served by a source of electrical power that is limited to not more than 100 W when tested in accordance with UL 62368-1.
- a. The term "fault limited" is intended to encompass most Class 1, 2, and 3 power-limited sources complying with Article 725 of NFPA 70; Class ES1 and ES2 electrical energy sources that are Class PS1 electrical power sources (e.g., USB); and Class ES3 electrical energy sources that are Class PS1 and PS2 electrical power sources (e.g., PoE). See UL 62368-1 for discussion of classes of electrical energy sources and classes of electrical power sources.
17. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
18. Jacket: A continuous nonmetallic outer covering for conductors or cables.
19. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

20. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
21. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
22. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein. Also called "single-line diagram."
23. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
24. Protective Device: A device that senses when an abnormal current flow, abnormal voltage potential, or other abnormal electrical waveform exists and then disconnects the affected portion of the circuit from the system. Common protective devices include fuses, circuit breakers, relays, ground-fault circuit interrupters, and arc-fault circuit interrupters.
25. Public Switched Telephone Network (PSTN): Analog telephone technology that uses twisted pair cables from a telephone-provider central office for the transmission medium. "PSTN" refers to the telephone network; "POTS" refers to the individual subscriber line.
26. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
27. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
28. Sheath: A continuous metallic covering for conductors or cables.
29. UL Category Control Number (CCN): An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
30. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.
31. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 - a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
 - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
 - c. Extra-Low Voltage (ELV): Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
 - d. Low Voltage (LV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
 - e. Medium Voltage (MV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
 - f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

32. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

1.3 SEQUENCING

- A. Conduct and submit results of power system studies before submitting product data and Shop Drawings for electrical equipment.

1.4 ACTION SUBMITTALS

- A. Coordination Drawings for Structural Supports: Show coordination of structural supports for equipment and devices, including restraints and bracing for control of seismic and wind loads, with other systems, equipment, and structural supports in the vicinity.
- B. Coordination Drawings for Ceiling Areas: Where indicated on drawings, provide reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, in accordance with Section 013100 "Project Management and Coordination," on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Suspended ceiling components.
 2. Structural members to which equipment and suspension systems will be attached.
 3. Size and location of access panels on ceilings.
 4. Elevation, size, and route of plumbing piping.
 5. Elevation, size, and route of ductwork.
 6. Elevation, size, and route of conduit.
 7. Elevation and size of wall-mounted and ceiling-mounted equipment.
 8. Access panels.
 9. Air inlets and outlets.
 10. Control modules.
 11. Luminaires.
 12. Communications devices.
 13. Speakers.
 14. Security devices.Indicate clear dimensions for maintenance access in front of equipment.
15. Indicate dimensions of fully open access doors.
- C. Coordination Drawings for Equipment Indoor Installations:
 1. Location plan, drawn to scale, showing heavy equipment or truck access paths to loading dock or other freight access into building. Indicate available width and height of doors or openings.
 2. Floor plan for entry floor and floor where equipment is located, drawn to scale, showing heavy equipment access paths for maintenance and replacement, with

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

the following items shown and coordinated with each other, based on input from installers of the items involved:

- a. Dimensioned concrete bases, outlines of equipment, conduit entries, and grounding equipment locations.
 - b. Dimensioned working clearances and dedicated areas below and around electrical equipment where obstructions and tripping hazards are prohibited.
3. Reflected ceiling plans for entry floor and floor where equipment is located, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
- a. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways and seismic bracing.
 - b. Location of lighting fixtures, sprinkler piping and sprinklers, ducts and diffusers, and other obstructions, indicating available overhead clearance.
 - c. Dimensioned working clearances and dedicated areas above and around electrical equipment where foreign systems and equipment are prohibited.
- D. Coordination Drawings for Equipment Outdoor Installations:
1. Utilities site plan, drawn to scale, showing heavy equipment or truck access paths for maintenance and replacement, with the following items shown and coordinated with each other, based on input from installers of the items involved:
 - a. Fences and walls, dimensioned concrete bases, outlines of equipment, conduit entries, and grounding and bonding locations.
 - b. Indicate clear dimensions for fence gates and wall openings.
 - c. Indicate depth and type of ground cover, and locations of trees, shrubbery, and other obstructions in access path.
 - d. Indicate clear height below tree branches, overhead lines, bridges, and other overhead obstructions in access path, or where cranes and hoists will be needed to handle large electrical equipment.
 - e. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways and seismic bracing.
 - f. Dimensioned working clearances and dedicated areas around electrical equipment.
- E. Coordination Drawings for Duct Banks:
1. Show duct profiles and coordination with other utilities and underground structures.
 2. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

1.5 INFORMATIONAL SUBMITTALS

- A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
1. Submission of power system studies.
 2. Submission of specified coordination drawings.
 3. Submission of action submittals specified in Division 26.
 4. Utility service inspection and activation.
 5. Closing of walls and ceilings containing electrical Work.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

6. System startup, testing, and commissioning activities for major electrical equipment.
 7. System startup, testing, and commissioning activities for emergency lighting.
 8. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
 9. Pouring of concrete housekeeping pads for electrical equipment and testing of concrete samples.
 10. Requests for special inspections.
 11. Requests for inspections by authorities having jurisdiction.
- B. Welding certificates.
- C. Seismic Performance Certificates: Provide special certification for designated seismic systems as required to meet requirements for the Project for all designated seismic systems identified on the Drawings or in the Specifications.
1. Include the following information:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - d. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
 - e. Equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the basis-of-design seismic criteria applicable to the Project.
 - f. Equipment manufacturer's written certification that components with hazardous contents maintain containment following the basis-of-design seismic criteria applicable to the Project.
 - g. Evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.
- D. Wind Performance Certificates: Provide special certification for systems and components designated on the Drawings or in the Specifications to be subject to high wind exposure and impact damage.
1. Include the following information:
 - a. Provide equipment manufacturer's written certification for each designated system and component, stating that it will remain in place and operable following the design wind event and comply with requirements of authorities having jurisdiction.
 - b. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.
- E. Qualification Statements:
1. For qualified regional manufacturer.
 2. For structural professional engineer.
 3. For welder.
 4. For generator set Installer.
 5. For low-voltage electrical testing agency and on-site electrical testing supervisor.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

6. For structural testing and inspecting agency.
7. For outdoor pole testing and inspecting agency.
8. For lighting testing and inspecting agency.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:
 - a. EPSS.
2. Include the following information:
 - a. Manufacturer's operating specifications.
 - b. User's guides for software and hardware.
 - c. Schedule of maintenance material items recommended to be stored at the Project site.
 - d. Detailed instructions covering operation under both normal and abnormal conditions.
 - e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
 - f. List of load-current and overload-relay heaters with related motor nameplate data.
 - g. List of lamp types and photoelectric relays used on the Project, with ANSI and manufacturers' codes.
 - h. Manufacturer's instructions for setting field-adjustable components.
 - i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
 - j. EPSS: Manufacturer's system checklists, maintenance schedule, and maintenance log sheets in accordance with NFPA 110.

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- #### A. Substitution requests for electrical equipment will be entertained under the following conditions:
1. Substitution requests may be submitted for consideration prior to the Electrical Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with the Project performance requirements while significantly increasing value for Owner throughout life of facility.
 2. Substitution requests may be submitted for consideration concurrently with submission of power system study reports when those reports indicate that substitution is necessary for safety of maintenance personnel and facility occupants.
 3. Contractor is responsible for sequencing and scheduling power system studies and electrical equipment procurement. After the Electrical Preconstruction Conference, insufficient lead time for electrical equipment delivery will not be considered a valid reason for substitution.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL WORK

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of electrical Work on the Project. Consult Architect for resolution of conflicting requirements.

END OF SECTION 260010

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper building wire.
 - 2. Connectors and splices.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
 - 2. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Alpha Wire; brand of Belden, Inc.
 - 2. Belden Inc.
 - 3. Cerro Wire LLC
 - 4. Encore Wire Corporation
 - 5. General Cable; Prysmian Group North America
 - 6. Okonite Company (The)
 - 7. Service Wire Co.
 - 8. Southwire Company, LLC
 - 9. WESCO
- B. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2. Comply with UL 83.
 - 2. Type XHHW-2. Comply with UL 44.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. 3M Electrical Products
 - 2. ABB, Electrification Business
 - 3. AFC Cable Systems; Atkore International
 - 4. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - 5. Gardner Bender
 - 6. Hubbell Utility Solutions; Hubbell Incorporated
 - 7. Ideal Industries, Inc.
 - 8. ILSCO
 - 9. NSi Industries LLC
 - 10. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - 11. Service Wire Co.
 - 12. TE Connectivity Ltd.
- B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One hole with standard barrels.
 - 3. Termination: Compression.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
 - 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
 - 1. Copper:
 - a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points in accordance with Section 260533.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each of the following visual and electrical tests:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
- 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backboards.
 - 2. Category 6 balanced twisted pair cable.
 - 3. Balanced twisted pair cable hardware.
 - 4. RS-232 cable.
 - 5. RS-485 cable.
 - 6. Control cable.
 - 7. Control-circuit conductors.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Backboards.
 - 2. Category 6 balanced twisted pair cable.
 - 3. Balanced twisted pair cable hardware.
 - 4. RS-232 cable.
 - 5. RS-485 cable.
 - 6. Control cable.
 - 7. Control-circuit conductors.

1.3 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inch or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Average Optical Smoke Density: 0.15 or less.

- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.2 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inch.
- B. Painting: Paint plywood on all sides and edges with eggshell latex paint. Comply

2.3 CATEGORY 6 BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden Inc.
 - 2. Berk-Tek, a Leviton Company
 - 3. CommScope, Inc
 - 4. General Cable; Prysmian Group North America
 - 5. Genesis; Resideo Technologies, Inc.
 - 6. Hitachi Cable America Inc.
 - 7. Mohawk; a division of Belden Networking, Inc.
 - 8. Prysmian Cables and Systems; Prysmian Group North America
 - 9. Superior Essex Inc.; subsidiary of LS Corp.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating: Plenum.
- F. Jacket: Gray thermoplastic.
- G.

2.4 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M
 - 2. American Technology Systems Industries, Inc
 - 3. AMP NETCONNECT; a TE Connectivity Ltd. company
 - 4. Belden Inc.
 - 5. Berk-Tek, a Leviton Company
 - 6. CommScope, Inc
 - 7. Dynacom Corporation
 - 8. General Cable; Prysmian Group North America
 - 9. Genesis; Resideo Technologies, Inc.
 - 10. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - 11. Leviton Manufacturing Co., Inc.
 - 12. Mohawk; a division of Belden Networking, Inc.
 - 13. Molex Premise Networks
 - 14. Panduit Corp
 - 15. Prysmian Cables and Systems; Prysmian Group North America
 - 16. Siemon Co. (The)
 - 17. Superior Essex Inc.; subsidiary of LS Corp.
- C. General Requirements for Balanced Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables must be terminated with connecting hardware of same category or higher.
- D. Patch Cords: Factory-made, four-pair cables in 48 inch lengths; terminated with an eight-position modular plug at each end.
 - 1. Patch cords must have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords must have latch guards to protect against snagging.
- E. Plugs and Plug Assemblies:
 - 1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
 - 2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
- F. Jacks and Jack Assemblies:
 - 1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
 - 2. Designed to snap-in to a patch panel or faceplate.
 - 3. Standards:
 - a. Category 6, unshielded balanced twisted pair cable must comply with IEC 60603-7-4.
 - b. Category 6, shielded balanced twisted pair cable must comply with IEC 60603-7.5.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.5 RS-232 CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Wire & Cable Inc.
 - 2. Belden Inc.
 - 3. General Cable; Prysmian Group North America
 - 4. Genesis; Resideo Technologies, Inc.
 - 5. Southwire Company, LLC
- B. PVC-Jacketed, TIA 232-F:
 - 1. No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. Polypropylene insulation.
 - 3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
 - 4. PVC jacket.
 - 5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 6. NFPA 70 Type: Type CM.
 - 7. Flame Resistance: Comply with UL 1581.
- C. Plenum-Type, TIA 232-F:
 - 1. No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. PE insulation.
 - 3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
 - 4. Fluorinated ethylene propylene jacket.
 - 5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.6 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CMG.
 - 1. Paired, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with UL 1685.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. Fluorinated ethylene propylene insulation.
 - 3. Unshielded.
 - 4. Fluorinated ethylene propylene jacket.
 - 5. Flame Resistance: NFPA 262.

2.7 CONTROL CABLE

- A. Paired Cable: NFPA 70, Type CMG.
 - 1. Twisted, tinned-copper conductors.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with UL 1685.
- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
1. Twisted, tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with NFPA 262.

2.8 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Encore Wire Corporation
 2. General Cable; Prysmian Group North America
 3. Service Wire Co.
 4. Southwire Company, LLC
- B. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- E. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
1. Smoke control signaling and control circuits.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test twisted pair cables according to TIA-568-C.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Test cables on receipt at Project site.
 - 1. Test each pair of twisted pair cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems" for raceway selection and installation requirements for conduits as supplemented or modified in this Section.
- B. Comply with requirements in Section 260533.16 "Boxes and Covers for Electrical Systems" for raceway selection and installation requirements for boxes as supplemented or modified in this Section.
 - 1. Outlet boxes for cables must be no smaller than 4 inch square by 2-1/8 inch deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
 - 2. Flexible metal conduit must not be used.
- C. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- D. Install manufactured conduit sweeps and long-radius elbows if possible.
- E. Raceway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard if entering the room from overhead.
 - 4. Extend conduits 3 inch above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96 inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
 5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
 6. Secure and support cables at intervals not exceeding **30 inch** and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
 10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
 11. Support: Do not allow cables to lie on removable ceiling tiles.
 12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
 13. Provide strain relief.
 14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
 15. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.
- C. Balanced Twisted Pair Cable Installation:
1. Comply with TIA-568-C.2.
 2. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways.
 2. Use insulated spade lugs for wire and cable connection to screw terminals.
- E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inch above ceilings by cable supports not more than 30 inch apart.
 3. Cable must not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- F. Separation from EMI Sources:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment must be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inch.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inch.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inch.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment must be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inch.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inch.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inch.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures must be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inch.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inch.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inch.

3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.5 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 1. Class 1 remote-control and signal circuits; No 14 AWG.
 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.6 FIRESTOPPING

- A. Comply with TIA-569-D, Annex A, "Firestopping."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Comply with BICSI TDMM, "Firestopping" Chapter.

3.7 GROUNDING

- A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.
- C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.9 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
 - a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

END OF SECTION 260523

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding bushings.
4. Grounding and bonding hubs.
5. Grounding and bonding connectors.
6. Intersystem bonding bridge grounding connectors.
7. Grounding and bonding busbars.
8. Grounding (earthing) electrodes.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
2. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
3. Section 270528 "Pathways for Communications Systems" specifies additional requirements for identification and grounding and bonding of communications equipment, raceways, boxes, and cable trays.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
 - b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
 - c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.

B. Field quality-control reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.

1.4 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures, conduct tests of complex equipment, analyze test and equipment data, plan a job, and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems, evaluate tests, test equipment, test results, and power system performance, recommend actions to maintain or improve system performance, and lead multi-team projects.
- C. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 - 1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.

1.5 SERVICE CONDITIONS FOR ELECTRICAL EQUIPMENT

- A. Soil Resistivity: Grounding (earthing) Work on the Project must account for soil resistivity conditions.
- B. Electrical and ICT Equipment Grounding (Earthing): Do not exceed 25 Ω resistance to ground (earth).
 - 1. Contact Architect for resolution if 25 Ω specified resistance to ground (earth) is not attained after complying with prescriptive requirements in Article 250 of NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 GROUNDING AND BONDING CONDUCTORS

- A. Equipment Grounding Conductor:
 - 1. Standard Features: 600 V, THHN/THWN-2 or THWN-2, copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. ASTM - Bare Copper Grounding and Bonding Conductor:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ERICO; brand of nVent Electrical plc
 - b. Harger Lightning & Grounding; business of Harger, Inc.
 - 2. Standard Features: Complying with one or more of the following:
 - a. Soft or Annealed Copper Wire: ASTM B3.
 - b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
 - c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
 - d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.3 GROUNDING AND BONDING CLAMPS

- A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.
- B. UL KDER and KDSH - Hex-Fitting-Type Pipe and Rod Grounding and Bonding Clamp:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. America Fujikura Ltd. (AFL); Fujikura Ltd.
 - c. Arlington Industries, Inc.
 - d. Cooper B-line; brand of Eaton, Electrical Sector
 - e. Crouse-Hinds; brand of Eaton, Electrical Sector
 - f. ERICO; brand of nVent Electrical plc
 - g. Galvan Industries, Inc.; Electrical Products Division, LLC
 - h. Greaves Corp.; Essex Products Group, Inc.
 - i. Harger Lightning & Grounding; business of Harger, Inc.
 - j. ILSCO
 - k. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - l. Panduit Corp
 - m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 - 4. Standard Features:
 - a. Two pieces with zinc-plated bolts.
 - b. Clamp Material: Tinned brass.
 - c. Listed for outdoor use.
- C. UL KDER and KDSH - U-Bolt-Type Pipe and Rod Grounding and Bonding Clamp:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. America Fujikura Ltd. (AFL); Fujikura Ltd.
 - c. Arlington Industries, Inc.
 - d. Cooper B-line; brand of Eaton, Electrical Sector
 - e. Crouse-Hinds; brand of Eaton, Electrical Sector
 - f. ERICO; brand of nVent Electrical plc
 - g. Galvan Industries, Inc.; Electrical Products Division, LLC
 - h. Greaves Corp.; Essex Products Group, Inc.
 - i. Harger Lightning & Grounding; business of Harger, Inc.
 - j. ILSCO
 - k. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - l. Panduit Corp
 - m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features:
 - a. Clamp Material: Tinned brass.
 - b. Listed for outdoor use.
- D. UL KDER and KDSH - Strap-Type Pipe and Rod Grounding and Bonding Clamp:
1. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector
 - c. ERICO; brand of nVent Electrical plc
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - e. Panduit Corp
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features:
 - a. Clamp Material: Tinned copper.
 - b. Listed for outdoor use.
- E. UL KDER - Beam Grounding and Bonding Clamp:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Anderson; brand of Hubbell Utility Solutions; Hubbell Incorporated
 - c. Panduit Corp
 - d. Penn-Union Corp.; subsidiary of Nesco, Inc.
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features: Mechanical-type, terminal, ground wire access from four directions; with dual, tin-plated or silicon bronze bolts.
- F. UL KDER - Exothermically Welded Connection:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. ALLTEC LLC
 - c. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated
 - d. Crouse-Hinds; brand of Eaton, Electrical Sector
 - e. ERICO; brand of nVent Electrical plc
 - f. Harger Lightning & Grounding; business of Harger, Inc.
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING AND BONDING BUSHINGS

- A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.
- B. UL KDER - Bonding Bushing:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Arlington Industries, Inc.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - 4. Standard Features: Threaded bushing with insulated throat.
- C. UL KDER - Grounding Bushing:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Arlington Industries, Inc.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - 4. Standard Features: Threaded bushing with insulated throat and mechanical-type wire terminal.

2.5 GROUNDING AND BONDING HUBS

- A. UL KDER - Grounding and Bonding Hub:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Arlington Industries, Inc.
 - c. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - d. Crouse-Hinds; brand of Eaton, Electrical Sector
 - e. Greaves Corp.; Essex Products Group, Inc.
 - f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - g. Penn-Union Corp.; subsidiary of Nesco, Inc.
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Standard Features: Insulated, gasketed, watertight hub with mechanical-type wire terminal.

2.6 GROUNDING AND BONDING CONNECTORS

- A. UL KDER - Pressure-Type Grounding and Bonding Busbar Cable Connector:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features: Copper or copper alloy, for compression bonding of one or more conductor directly to copper busbar. Listed for direct burial.
- B. UL KDER - Lay-In Lug Mechanical-Type Grounding and Bonding Busbar Terminal:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following, provide products by one of the following:
 - a. ABB, Electrification Business
 - b. Chatsworth Products, Inc.
 - c. Greaves Corp.; Essex Products Group, Inc.
 - d. ILSCO
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features: Mechanical-type, aluminum terminal with set screw.
- C. UL KDER - Crimped Lug Pressure-Type Grounding and Bonding Busbar Terminal:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Harger Lightning & Grounding; business of Harger, Inc.
 - c. ILSCO
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Standard Features: Cast silicon bronze, solderless compression-type wire terminals; with long barrel and two holes spaced on **5/8 or 1 inch** centers for two-bolt connection to busbar.
- D. UL KDER - Split-Bolt Service-Post Pressure-Type Grounding and Bonding Busbar Terminal:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Panduit Corp
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features: Bolts that surround cable and bond to cable under compression when nut is tightened after assembly is screwed into busbar opening.
- E. UL KDER - Crimped Pressure-Type Grounding and Bonding Cable Connector:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. allG Fabrication (formerly ALT)
 - c. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - d. ILSCO
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 4. Standard Features: Crimp-and-compress connectors that bond to conductor when connector is compressed around conductor.
 - a. Tinned copper, C and H shaped.
- F. UL KDER - Split-Bolt Pressure-Type Grounding and Bonding Cable Connector:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. allG Fabrication (formerly ALT)
 - c. ERICO; brand of nVent Electrical plc
 - d. Greaves Corp.; Essex Products Group, Inc.
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
- 4. Standard Features: Bolts that surround cable and bond to cable under compression when nut is tightened.
 - a. Tinned copper.

2.7 INTERSYSTEM BONDING BRIDGE GROUNDING CONNECTORS

- A. Description: Devices that provide means for connecting communications systems grounding and bonding conductors at service equipment or at disconnecting means for buildings or structures.
- B. UL KDSH - One-Piece Intersystem Bonding Bridge Grounding Connector:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Galvan Industries, Inc.; Electrical Products Division, LLC
 - b. Madison Electric Products; business of Southwire Company, LLC
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 - 3. Standard Features: Zinc-alloy one-piece construction; six terminating points; gangable.
- C. UL KDSH - Two-Piece Intersystem Bonding Bridge Grounding Connector:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector
 - c. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 - 3. Standard Features: Copper body and polycarbonate cover; four terminating points.

2.8 GROUNDING AND BONDING BUSBARS

- A. Description: Miscellaneous grounding and bonding devices that serve as common connection for multiple grounding and bonding conductors.
- B. UL KDER - Equipment Room Grounding and Bonding Busbar:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. allG Fabrication (formerly ALT)

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Chatsworth Products, Inc.
- c. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated
- d. Cooper B-line; brand of Eaton, Electrical Sector
- e. ERICO; brand of nVent Electrical plc
- f. Harger Lightning & Grounding; business of Harger, Inc.
- g. Hoffman; brand of nVent Electrical plc
- h. ILSCO
- i. Panduit Corp
- 2. Source Limitations: Obtain products from single manufacturer.
- 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- 4. Standard Features:
 - a. Bus: Rectangular bar of annealed copper.
 - b. Mounting Stand-Off Insulators: Lexan or PVC.
 - 1) Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.
- 5. Other Available Features Required by the Project:
 - a. Dimensions: 1/4 by 4 inch in cross section; length as indicated on the Drawings.
 - b. Mounting Hardware: Stand-off brackets that provide 4 inch clearance to access rear of bus. Brackets and bolts must be stainless steel.

2.9 GROUNDING (EARTHING) ELECTRODES

A. UL KDER - Rod Electrode:

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. allG Fabrication (formerly ALT)
 - c. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated
 - d. ERICO; brand of nVent Electrical plc
 - e. Galvan Industries, Inc.; Electrical Products Division, LLC
 - f. Harger Lightning & Grounding; business of Harger, Inc.
- 2. Source Limitations: Obtain products from single manufacturer.
- 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- 4. Standard Features: Copper-clad steel; 3/4 inch by 10 ft.

B. UL KDER - Plate Electrode:

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ALLTEC LLC
 - b. Galvan Industries, Inc.; Electrical Products Division, LLC
- 2. Source Limitations: Obtain products from single manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
- B. Inspect test results of grounding system measured at point of electrical service equipment connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF GROUNDING AND BONDING PRODUCTS

- A. Grounding and Bonding Conductors:
 1. Provide solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
 2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
 3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.
 4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
 7. Underground Grounding Conductors: Install bare copper conductor, 2/0 AWG minimum.
- B. Grounding and Bonding Connectors:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Welded connectors.
- C. Grounding and Bonding Busbars: Provide in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated on the Drawings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.3 INSTALLATION OF GROUNDING AND BONDING

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
 - 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Electrical Maintenance: NFPA 70B.
 - 3. Electrical Safety: NFPA 70E.
 - 4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 - 5. Communications Work: BICSI N1.
 - 6. Work in ITE Rooms: NFPA 75.
 - 7.
 - 8. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
 - 9. Work in Confined Spaces: NFPA 350.
 - 10. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 - 11. Consult Architect for resolution of conflicting requirements.
- C. Special Techniques:
 - 1. Grounding and Bonding Conductors:
 - a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 - b. Underground Grounding Conductors:
 - 1) Bury at least 30 inch below grade.
 - 2. Grounding and Bonding Connectors: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - b. Make connections with clean, bare metal at points of contact.
 - c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
 - d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 - f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
 - 2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
 - g. Grounding and Bonding for Piping:
 - 1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or

- grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.
 - 3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
 - h. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft apart.
3. Grounding and Bonding Busbars:
 - a. Install busbar horizontally, on insulated spacers 2 inch minimum from wall, 6 inch above finished floor unless otherwise indicated.
 - b. Where busbars are indicated on both sides of doorways, route bonding conductor up to top of door frame, across top of doorway, and down; connect to continuation of horizontal busbar.
4. Electrodes:
 - a. Ground Rods: Drive rods until tops are 2 inch below finished floor or final grade unless otherwise indicated.
 - 1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2) Use exothermic welds for below-grade connections.
 - b. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.
 - c. Concrete-Encased Electrode (Ufer Ground):
 - 1) Fabricate in accordance with NFPA 70; use minimum of 20 ft of bare copper conductor not smaller than 4 AWG.
 - a) If concrete foundation is less than 20 ft long, coil excess conductor within base of foundation.
 - b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
 - 2) Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.
5. Grounding at Service:
 - a. Equipment grounding conductors and grounding electrode conductors must be connected to ground busbar. Install main bonding jumper between neutral and ground buses.
6. Grounding Underground Distribution System Components:
 - a. Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Comply with IEEE C2 grounding requirements.
- c. Pad-Mounted Transformers and Switches: Install two ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than 2 AWG for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than **6 inch** from foundation.
- 7. Equipment Grounding and Bonding:
 - a. Install insulated equipment grounding conductors with feeders and branch circuits.
 - b. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
 - c. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
 - d. Poles Supporting Outdoor Lighting Fixtures: Bond insulated equipment grounding conductor to equipment grounding terminal inside pole base.

3.4 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

- A. Administrant for Electrical Power Tests and Inspections:
 - 1. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
 - 3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
 - c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.
- C. Nonconforming Work:
 - 1. Grounding system will be considered defective if it does not pass tests and inspections.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Remove and replace defective components and retest.
- D. Collect, assemble, and submit test and inspection reports.
 1. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω .
 - b. Substations and Pad-Mounted Equipment: 5 Ω .

3.5 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Support systems.
 - 2. Mounting, anchoring, and attachment components.
 - 3. Installation of fabricated metal supports.
 - 4. Installation of concrete bases.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
 - 2. Section 260548 "Vibration and Seismic Controls for Electrical Systems" specifies vibration controls, seismic restraints, and wind restraints referenced by this Section.

1.2 DELEGATED DESIGN SERVICES

- A. Delegated Design Professionals: Engage qualified structural professional engineer to design hangers and supports for electrical systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
 - 1. Hangers. Include product data for components.
 - 2. Slotted support systems.
 - 3. Equipment supports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated Design Submittals: For hangers and supports for electrical systems.
 1. Include design calculations and details of hangers.
 2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 REGULATORY AGENCY APPROVALS

- A. Delegated design submittals and shop drawings requiring approval by authorities having jurisdiction must be signed by qualified structural professional engineer responsible for their preparation. Submit for action by Architect prior to submitting for approval by authorities having jurisdiction.

1.6 QUALIFICATIONS

- A. Structural Professional Engineer: Professional engineer possessing active qualifications specified in Section 014000 "Quality Requirements," with expertise in structural engineering, including design of seismic and wind controls, equipment hangers and supports, and concrete foundations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Prepare design calculations in accordance with criteria specified in Section 260010 "Supplemental Requirements for Electrical."

2.2 SUPPORT SYSTEMS

- A. Steel Slotted Support Systems:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Allied Tube & Conduit; Atkore International
 - c. Atkore Unistrut
 - d. CADDY; brand of nVent Electrical plc
 - e. Cooper B-line; brand of Eaton, Electrical Sector
 - f. Flex-Strut Inc.
 - g. G-Strut
 - h. Gripple Inc.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- i. Haydon Corporation
 - j. Metal Ties Innovation
 - k. MIRO Industries Inc.
 - l. Rocket Rack; Robroy Industries
 - m. Wesanco/ZSi-Foster; an Ideal Tridon Group Company
 2. Standard Features: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
 - a. Referenced Standard: MFMA-4 factory-fabricated components for field assembly.
 - b. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - c. Channel Width: Selected for applicable load criteria.
 - d. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices:
1. Standard Features: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit:
1. Standard Features: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints:
1. Standard Features: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

2.3 MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS

- A. Powder-Actuated Fasteners:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. MKT Fastening, LLC
 2. Standard Features: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Cooper B-line; brand of Eaton, Electrical Sector
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - e. MKT Fastening, LLC

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Standard Features: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
- C. Concrete Inserts:
 1. Standard Features: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
- D. Clamps for Attachment to Steel Structural Elements:
 1. Standard Features: MSS SP-58 units are suitable for attached structural element.
- E. Through Bolts:
 1. Standard Features: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
- F. Toggle Bolts:
 1. Standard Features: All steel springhead type.
- G. Hanger Rods:
 1. Standard Features: Threaded steel.

PART 3 - EXECUTION

3.1 SELECTION OF HANGERS AND SUPPORTS

- A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT as required by NFPA 70. Minimum rod size must be 1/4 inch in diameter.
- B. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least **25** percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 2. Hot Work: NFPA 51B.
 3. Work in Confined Spaces: NFPA 350.
 4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 5. Installation of Steel Conduit: NECA NEIS 101.
 6. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT and ERM C may be supported by openings through structure members, in accordance with NFPA 70.
2. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb.
3. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - a. To Wood: Fasten with lag screws or through bolts.
 - b. To New Concrete: Bolt to concrete inserts.
 - c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - d. To Existing Concrete: Expansion anchor fasteners.
 - e. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch thick.
 - f. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - g. To Light Steel: Sheet metal screws.
 - h. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
4. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

D. Interfaces with Other Work:

1. Provide vibration and seismic controls with hangers and supports.
2. Touchup Finishes:
 - a. 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 minimum dry film thickness of 2.0 mils.
3. Installation of Fabricated Metal Supports:
 - a. Provide site-fabricated metal supports.
 - b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
 - c. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.
4. Installation of Concrete Bases:
 - a. Provide concrete bases of dimensions indicated, but not less than 4 inch larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
 - b. Use 3000 psi, 28-day compressive-strength concrete.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Anchor equipment to concrete base as follows:
 - 1) Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2) Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3) Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 260529

SECTION 260533.13 - CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EMT duct raceways and elbows.
2. Type ERMC duct raceways, elbows, couplings, and nipples.
3. Type FMT duct raceways.
4. Type LFMC duct raceways.
5. Type PVC duct raceways and fittings.
6. Fittings for conduit, tubing, and cable.
7. Joint compounds.
8. Solvent cements.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
2. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" specifies nonmetallic underground conduit with conductors (Type NUCC).
3. Section 260529 "Hangers and Supports for Electrical Systems" specifies conduit hangers and supports referenced by this Section.
4. Section 260543 "Underground Ducts and Raceways for Electrical Systems" specifies exterior duct banks, manholes, and underground utility construction.
5. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels.
6. Section 270528 "Pathways for Communications Systems" specifies additional requirements for installation of conduits for communications cabling.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Raceway Types:

1. EMT: Electrical metallic tubing.
2. EMT-A: Aluminum electrical metallic tubing.
3. EMT-S: Steel electrical metallic tubing.
4. EMT-SS: Stainless steel electrical metallic tubing.
5. ENT: Electrical nonmetallic tubing.
6. EPEC: Electrical HDPE underground conduit (thin wall).
7. EPEC-A: Type A electrical HDPE underground conduit.
8. EPEC-B: Type B electrical HDPE underground conduit.
9. ERMC: Electrical rigid metal conduit.
10. ERMC-A: Aluminum electrical rigid metal conduit.
11. ERMC-S: Steel electrical rigid metal conduit.
12. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

13. ERM-C-S-PVC: PVC-coated-steel electrical rigid metal conduit.
14. ERM-C-SS: Stainless steel electrical rigid metal conduit.
15. FMC: Flexible metal conduit.
16. FMC-A: Aluminum flexible metal conduit.
17. FMC-S: Steel flexible metal conduit.
18. FMT: Steel flexible metallic tubing.
19. FNMC: Flexible nonmetallic conduit. See "LFNC."
20. HDPE: HDPE underground conduit (thick wall).
21. HDPE-40: Schedule 40 HDPE underground conduit.
22. HDPE-80: Schedule 80 HDPE underground conduit.
23. IMC: Steel electrical intermediate metal conduit.
24. LFMC: Liquidtight flexible metal conduit.
25. LFMC-A: Aluminum liquidtight flexible metal conduit.
26. LFMC-S: Steel liquidtight flexible metal conduit.
27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
28. LFNC: Liquidtight flexible nonmetallic conduit.
29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
32. PVC: Rigid PVC conduit.
33. PVC-40: Schedule 40 rigid PVC conduit.
34. PVC-80: Schedule 80 rigid PVC Conduit.
35. PVC-A: Type A rigid PVC concrete-encased conduit.
36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
37. RGS: See ERM-C-S-G.
38. RMC: See ERM-C.
39. RTRC: Reinforced thermosetting resin conduit.
40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
44. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.

B. Definitions:

1. Conduit: A structure containing one or more duct raceways.
2. Direct Buried: Installed underground without encasement in concrete or other protective material.
3. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.
4. Duct Raceway: A single enclosed raceway for conductors or cable.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.

1.5 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures; conduct tests of complex equipment; analyze test and equipment data; plan a job; and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems; evaluate tests, test equipment, test results, and power system performance; recommend actions to maintain or improve system performance; and lead multi-team projects.
- C. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 - 1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 TYPE EMT DUCT RACEWAYS AND ELBOWS

- A. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Allied Tube & Conduit; Atkore International
 - b. Calconduit; Atkore International
 - c. Emerson Electric Co., Automation Solutions
 - d. Picoma; Zekelman Industries
 - e. Republic Conduit; Nucor Corporation, Nucor Tubular Products
 - f. Topaz Lighting & Electric
 - g. Western Tube; Zekelman Industries
 - h. Wheatland Tube; Zekelman Industries
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN FJMX; including UL 797.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Standard Features:
 - a. Material: Steel.
 - b. Exterior Coating: Zinc.
 - c. Interior Coating: Zinc with organic top coating.
 - d. Minimum Trade Size: Metric designator 21 (trade size 3/4).
4. Sustainable Design Features:

2.3 TYPE ERM C DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. UL DYIX - Galvanized-Steel Electrical Rigid Metal Conduit (ERM C-S-G), Elbows, Couplings, and Nipples:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Allied Tube & Conduit; Atkore International
 - b. Calconduit; Atkore International
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - e. Patriot Aluminum Products, LLC
 - f. Republic Conduit; Nucor Corporation, Nucor Tubular Products
 - g. Rymco USA brand; manufactured and listed by subsidiary Conduit S.A. de C.V
 - h. Topaz Lighting & Electric
 - i. Western Tube; Zekelman Industries
 - j. Wheatland Tube; Zekelman Industries
 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DYIX; including UL 6.
 3. Standard Features:
 - a. Exterior Coating: Zinc.
 - b. Interior Coating: Zinc with organic top coating.
 - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.4 TYPE FMC DUCT RACEWAYS

- A. UL DXUZ - Steel Flexible Metal Conduit (FMC-S):
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Anaconda Sealtite; Anamet Electrical, Inc
 - c. Electri-Flex Company
 - d. International Metal Hose Co.
 - e. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway
 - f. Topaz Lighting & Electric
 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DXUZ; including UL 1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Standard Features:
 - a. Material: Steel.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.5 TYPE LFMC DUCT RACEWAYS

- A. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Anaconda Sealtite; Anamet Electrical, Inc
 - c. Electri-Flex Company
 - d. International Metal Hose Co
 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DXHR; including UL 360.
 3. Standard Features:
 - a. Material: Steel.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.6 TYPE PVC DUCT RACEWAYS AND FITTINGS

- A. UL DZXR - Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Calconduit; Atkore International
 - c. JM Eagle
 - d. NAPCO; Westlake Chemical Corp.
 - e. National Pipe and Plastic, Inc. (Oldcastle)
 - f. Opti-Com Manufacturing Network, Inc (OMNI)
 - g. Topaz Lighting & Electric
 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DZXR; including UL 651.
 3. Standard Features:
 - a. Dimensional Specifications: Schedule 40.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - c. Markings: For use with maximum 90 deg C wire.

2.7 FITTINGS FOR CONDUIT, TUBING, AND CABLE

- A. UL DWTT - Fittings for Type ERM, and Type PVC, Duct Raceways:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. Konkore Fittings; Atkore International
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - f. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway
 - g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. Southwire Company, LLC
 - i. Topaz Lighting & Electric
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN DWTT; including UL 514B.
 - 3. Standard Features:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling].
 - c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.
- B. UL FKAV - Fittings for Type EMT Duct Raceways:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Allied Tube & Conduit; Atkore International
 - c. Appleton; Emerson Electric Co., Automation Solutions
 - d. Calconduit; Atkore International
 - e. Crouse-Hinds; brand of Eaton, Electrical Sector
 - f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. Southwire Company, LLC
 - i. Topaz Lighting & Electric
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN FKAV; including UL 514B.
 - 3. Standard Features:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling.
 - c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.
- C. UL DXAS - Fittings for Type LFMC Duct Raceways:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Arlington Industries, Inc.
 - b. Liquid Tight Connector Co.
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. UL CCN DXAS; including UL 514B.

2.8 JOINT COMPOUNDS

- A. UL FOIZ - Electrically Conductive Corrosion-Resistant Compound for Threaded Conduit:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN FOIZ; including UL Subject 2419.

2.9 SOLVENT CEMENTS

- A. UL VBEW - Solvent Cements for Nonmetallic Duct Raceways and Fittings:
 - 1. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Solvent Cements: UL CCN VBEW; including UL 340.
 - b. Solvent Cement Compatibility with PVC Conduit Fittings: UL CCN DWTT; including UL 514B. Follow solvent manufacturer's published instructions.
 - c. Solvent Cement Compatibility with Rigid PVC Conduit: UL CCN DZYR; including UL 651. Follow solvent manufacturer's published instructions.
 - d. Solvent Cement Compatibility with Rigid EPEC and HDPE Underground Conduit: UL CCN EAZX; including UL 651A. Follow solvent manufacturer's published instructions.

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturer's published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
 - 1. Exposed and Subject to Severe Physical Damage: ERM C.
 - 2. Exposed and Subject to Physical Damage: ERM C.
 - 3. Exposed and Not Subject to Physical Damage: ERM C.
 - 4. Concealed Aboveground: ERM C.
 - 5. Direct Buried: PVC-40.
 - 6. Concrete Encased Not in Trench: PVC-40.
 - 7. Concrete Encased in Trench: PVC-40.
 - 8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFM C.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Indoors:
 - 1. Exposed and Subject to Severe Physical Damage: ERM C.
 - 2. Exposed and Subject to Physical Damage: ERM C.
 - 3. Exposed and Not Subject to Physical Damage: EMT.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 5. Damp or Wet Locations: ERM C.
 - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC or FMC.
- D. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
 - 1. ERM C and IMC: Provide threaded-type fittings unless otherwise indicated.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
 - 1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Electrical Safety: NFPA 70E.
 - 3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 - 4. Communications Work: BICSI N1.
 - 5. Life Safety and Means of Egress Work: NFPA 101.
 - 6. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
 - 7. Work in Confined Spaces: NFPA 350.
 - 8. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 - 9. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
 - 10. Type ERM C-S: Article 344 of NFPA 70 and NECA NEIS 101.
 - 11. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
 - 12. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
 - 13. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
 - 14. Expansion Fittings: NEMA FB 2.40.
 - 15. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. General Requirements for Installation of Duct Raceways:
 - a. Complete duct raceway installation before starting conductor installation.
 - b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
 - c. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
 - d. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- minimum radii requirements. Provide only equipment specifically designed for material and size involved.
- e. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 - f. Support conduit within 12 inch of enclosures to which attached.
 - g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
 - h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:
 - 1) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2) Where an underground service duct raceway enters a building or structure.
 - 3) Conduit extending from interior to exterior of building.
 - 4) Conduit extending into pressurized duct raceway and equipment.
 - 5) Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6) Where otherwise required by NFPA 70.
 - i. Do not install duct raceways or electrical items on "explosion-relief" walls or rotating equipment.
 - j. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
 - k. Keep duct raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.
 - l. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
 - m. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.
 - n. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 - 1) Termination fittings with shoulders do not require two locknuts.
 - o. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- 2. Types EMT-A, ERMC-A, and FMC-A: Do not install aluminum duct raceways or fittings in contact with concrete or earth.
 - 3. Types ERMC:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.
4. Types FMC and LFMC:
 - a. Provide a maximum of 36 inch of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
5. Types PVC:
 - a. Do not install Type PVC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
 - b. Comply with manufacturer's published instructions for solvent welding and fittings.
 - c. Join joints with solvent cement in accordance with manufacturer's published instructions and allowed to cure before handling. Joints to be bent, pushed, or pulled must set for minimum 24 h after joining.
6. Duct Raceways Embedded in Slabs:
 - a. Run duct raceways larger than metric designator 27 (trade size 1) below concrete slab.
 - b. Arrange duct raceways to cross building expansion joints with expansion fittings at right angles to the joint.
 - c. Arrange duct raceways to ensure that each is surrounded by minimum of 1 inch of concrete without voids.
 - d. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
 - e. Change from ENT to ERMCM before rising above floor.
7. Stub-ups to Above Recessed Ceilings:
 - a. Provide EMT or ERMCM for duct raceways.
 - b. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
8. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG. Install insulated throat metal grounding bushings on service conduits.
9. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
 - a. EMT: Provide compression, steel fittings. Comply with NEMA FB 2.10.
 - b. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
10. Expansion-Joint Fittings:
 - a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERMCM conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
 - b. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - 1) Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 2) Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - 3) Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - c. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - d. Install expansion fittings at locations where conduits cross building or structure expansion joints.
 - e. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's published instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
 - 11. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.
 - 12. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.
 - a. Provide warning signs.
- D. Interfaces with Other Work:
- 1. Firestop penetrations of fire-rated floor and wall assemblies.
 - 2. Provide conduit hangers and supports.

3.3 FIELD QUALITY CONTROL OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Administrant for Electrical Power Tests and Inspections:
- 1. Administer and perform tests and inspections.
- B. Tests and Inspections:
- 1. Perform manufacturer's recommended tests and inspections.
 - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
 - 3. Conduit Placement:
 - a. Verify that center-line location and offsets are in accordance with the Drawings.
 - b. Verify that hangers and supports for conduits are attached to structure as directed by qualified structural engineer.
 - c. Verify that nuts on bolts or hanger rods are secure.
 - d. Verify that space between raceways and cored holes are filled with non-shrinking grout or other approved material indicated on the Drawings and the Specifications.
 - e. Verify that expansion devices are installed at locations indicated on the Drawings and the Specifications.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- f. Verify that ends are cut square to provide flush-butting surfaces when spliced and inside edges are free of burrs that could impede installation of cables.
 - g. Verify minimum separation of utilities, or that approved mechanical protection has been provided to surrounding conduit(s) where minimum separation cannot be achieved.
- 4. Document all changes on Record Drawings.

C. Nonconforming Work:

- 1. Conduit will be considered defective if it does not pass tests and inspections.
- 2. Remove and replace defective units and retest.

D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.4 CLEANING

- A. Verify that bentonite or other drilling fluids are contained and removed, and site is restored to its original or improved condition.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533.13

SECTION 260533.16 - BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metallic outlet boxes, device boxes, rings, and covers.
 - 2. Junction boxes and pull boxes.
 - 3. Cover plates for device boxes.
 - 4. Hoods for outlet boxes.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
 - 2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
 - 3. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
 - 4. Section 260573 "Power System Studies" specifies arc-flash hazard analysis and warning labels referenced by this Section.
 - 5. Section 270528 "Pathways for Communications Systems" specifies additional requirements for identification of communications equipment and cabling.

1.2 DEFINITIONS

- A. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
- B. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
 - 1. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
 - 2. Concrete Box: A box intended for use in poured concrete.
 - 3. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - 4. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

5. Cover Plate: A cover designed for protecting wiring devices installed in flush-mounted device boxes while permitting their safe operation; also called a faceplate or wallplate.
 6. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
 7. Device Box: A box with provisions for mounting a wiring device directly to the box.
 8. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
 9. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
 10. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
 11. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
 12. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
 13. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
 14. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
 15. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
 16. Raised-Floor Box: A floor box intended for use in raised floors.
 17. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
 18. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
 19. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
 20. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
 21. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
- C. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
- D. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.

1.5 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures; conduct tests of complex equipment; analyze test and equipment data; plan a job; and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems; evaluate tests, test equipment, test results, and power system performance; recommend actions to maintain or improve system performance; and lead multi-team projects.
- C. Inspection and Testing of Fire-Alarm Systems (I&TFAS) Technician I: Possessing active NICET I&TFAS Level I certification. Able to perform periodic inspections and tests of basic fire-alarm systems and prepare related records and reports.
- D. Inspection and Testing of Fire-Alarm Systems (I&TFAS) Technician II: Possessing active NICET I&TFAS Level II certification. Able to plan, perform, and coordinate periodic inspections and tests of complex fire-alarm systems (including one or more of suppression interfaces, networked control units, smoke control interfaces, air sampling systems, multi-zone voice evacuation systems, or high-rise applications) and prepare related records and reports.
- E. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 - 1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.2 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. UL QCIT - Metallic Outlet Boxes and Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Arlington Industries, Inc.
 - d. Crouse-Hinds; brand of Eaton, Electrical Sector
 - e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. MonoSystems, Inc
 - i. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - j. Pass & Seymour; Legrand North America, LLC
 - k. Patriot Aluminum Products, LLC
 - l. Plasti-Bond; Robroy Industries
 - m. Racor Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - n. Spring City Electrical Manufacturing Company
 - o. Topaz Lighting & Electric
 - p. Wiremold; Legrand North America, LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
3. Standard Features:
 - a. Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
 - b. Material: Sheet steel.
 - c. Sheet Metal Depth: Minimum 2.5 inch.
 - d. Cast-Metal Depth: Minimum 2.4 inch.
4. Other Available Features Required by the Project:
 - a. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.

B. UL QCIT - Metallic Conduit Bodies:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - f. Pass & Seymour; Legrand North America, LLC

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- g. Patriot Aluminum Products, LLC
 - h. Plasti-Bond; Robroy Industries
 - i. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - j. Topaz Lighting & Electric
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
 - 3. Standard Features: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
- C. UL QCIT - Metallic Device Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Arlington Industries, Inc.
 - d. Crouse-Hinds; brand of Eaton, Electrical Sector
 - e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - i. Patriot Aluminum Products, LLC
 - j. Plasti-Bond; Robroy Industries
 - k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - l. Topaz Lighting & Electric
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
 - 3. Standard Features:
 - a. Box with provisions for mounting wiring device directly to box.
 - b. Material: Sheet steel.
 - c. Sheet Metal Depth: minimum 2.5 inch.
 - d. Cast-Metal Depth: minimum 2.4 inch.
- D. UL QCIT - Metallic Extension Rings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Cooper B-line; brand of Eaton, Electrical Sector
 - d. Crouse-Hinds; brand of Eaton, Electrical Sector

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - g. Pass & Seymour; Legrand North America, LLC
 - h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - i. Topaz Lighting & Electric
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
 - 3. Standard Features: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
- E. UL QCIT - Metallic Floor Boxes and Floor Box Covers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. AFC Cable Systems; Atkore International
 - c. Arlington Industries, Inc.
 - d. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - e. FSR Inc.
 - f. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. Leviton Manufacturing Co., Inc.
 - i. Pass & Seymour; Legrand North America, LLC
 - j. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - k. Wiremold; Legrand North America, LLC
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
 - 3. Standard Features: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
- F. UL QCIT - Metallic Concrete Boxes and Covers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector
 - c. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - e. Topaz Lighting & Electric
 - f. Wiremold; Legrand North America, LLC

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT; including UL 514A.
3. Standard Features: Box intended for use in poured concrete.

2.3 JUNCTION BOXES AND PULL BOXES

A. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Adalet
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Cooper B-line; brand of Eaton, Electrical Sector
 - d. FSR Inc.
 - e. Hoffman; brand of nVent Electrical plc
 - f. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. Milbank Manufacturing Company
 - i. N J Sullivan Company
 - j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - l. Spring City Electrical Manufacturing Company
 - m. Square D; Schneider Electric USA
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN BGUZ; including UL 50 and UL 50E.
3. Standard Features:
 - a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - b. Degree of Protection: Type 1].

B. UL BGUZ - Indoor Cast-Metal Junction and Pull Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Adalet
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN BGUZ; including UL 50 and UL 50E.
3. Standard Features:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - b. Degree of Protection: Type 1.
- C. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Adalet
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Cooper B-line; brand of Eaton, Electrical Sector
 - d. FSR Inc.
 - e. Hoffman; brand of nVent Electrical plc
 - f. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. Milbank Manufacturing Company
 - i. N J Sullivan Company
 - j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - k. Racal Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - l. Spring City Electrical Manufacturing Company
 - m. Square D; Schneider Electric USA
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN BGUZ; including UL 50 and UL 50E.
 - 3. Standard Features:
 - a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - b. Degree of Protection: Type 3R.
- D. UL BGUZ - Outdoor Cast-Metal Junction and Pull Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Adalet
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN BGUZ; including UL 50 and UL 50E.
 - 3. Standard Features:
 - a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - b. Degree of Protection: Type 3R.
- E. UL BGUZ - Outdoor Polymeric Junction and Pull Boxes:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Allied Tube & Conduit; Atkore International
 - c. Cantex Inc.
 - d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - e. JM Eagle
 - f. Robroy Enclosures; Robroy Industries
 - g. Topaz Lighting & Electric
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN BGUZ; including UL 50 and UL 50E.
3. Standard Features:
 - a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - b. Degree of Protection: Type 3R.

2.4 COVER PLATES FOR DEVICE BOXES

- A. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - d. Crouse-Hinds; brand of Eaton, Electrical Sector
 - e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - g. Intermatic, Inc
 - h. Leviton Manufacturing Co., Inc.
 - i. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - j. Panduit Corp
 - k. Pass & Seymour; Legrand North America, LLC
 - l. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - m. Topaz Lighting & Electric
 - n. Wiremold; Legrand North America, LLC
 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.
 3. Standard Features:
 - a. Cover plate-Securing Screws: Metal with head color to match cover plate finish.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - c. Cover Plate Material: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish.
- B. UL QCIT or QCMZ - Nonmetallic Cover Plates for Device Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABB, Electrification Business
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Arlington Industries, Inc.
 - d. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - e. Crouse-Hinds; brand of Eaton, Electrical Sector
 - f. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. Intermatic, Inc
 - i. Leviton Manufacturing Co., Inc.
 - j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - k. Panduit Corp
 - l. Pass & Seymour; Legrand North America, LLC
 - m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - n. Topaz Lighting & Electric
 - o. Wiremold; Legrand North America, LLC
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.
 - 3. Standard Features:
 - a. Cover Plate-Securing Screws: Metal with head color to match cover plate finish.
 - b. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - c. Cover Plate Material: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.
 - d. Color: White.

2.5 HOODS FOR OUTLET BOXES

- A. UL QCIT or QCMZ - Extra-Duty, While-in-Use Hoods for Outlet Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Allied Tube & Conduit; Atkore International
 - c. Appleton; Emerson Electric Co., Automation Solutions

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Arlington Industries, Inc.
 - e. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - f. Intermatic, Inc
 - g. Leviton Manufacturing Co., Inc.
 - h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
- a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.
 - b. Receptacle, Hood, Cover Plate, Gaskets, and Seals: UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
3. Standard Features:
- a. Mounts to box using fasteners different from wiring device.
 - b. Marked "Extra-Duty" in accordance with UL 514D.
 - c. Provides gray, weatherproof, "while-in-use" cover.
 - d. Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.1 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
- 1. Outdoors:
 - a. Type 3R unless otherwise indicated.
 - 2. Indoors:
 - a. Type 1 unless otherwise indicated.
- C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
- 1. Provide cast-metal boxes.
 - 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.2 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
- 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Electrical Safety: NFPA 70E.
 3. Commissioning of Active and Passive Fire Protection Features: NFPA 3 and NFPA 4.
 4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 5. Communications Work: BICSI N1.
 6. Life Safety and Means of Egress Work: NFPA 101.
 7. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
 8. Work in Confined Spaces: NFPA 350.
 9. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 10. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
 11. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
 2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
 3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
 4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 5. Locate boxes so that cover or plate will not span different building finishes.
 6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
 7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
 8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
 9. Set metal floor boxes level and flush with finished floor surface.
 10. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
 11. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
 12. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
 13. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - b. Provide gaskets for cover plates and covers.
- D. Interfaces with Other Work:
1. Identification: Provide labels for boxes and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Label each enclosure with engraved metal or laminated-plastic nameplate.
 - c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.3 FIELD QUALITY CONTROL OF BOXES AND COVERS

- A. Administrant for Electrical Power Tests and Inspections:
 - 1. Administer and perform tests and inspections.
- B. Tests and Inspections:
 - 1. Perform manufacturer's recommended tests and inspections.
 - 2. Perform tests and inspections recommended by standards listed in "Reference Standards for Installation" Paragraph.
- C. Nonconforming Work:
 - 1. Boxes and covers will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.4 CLEANING

- A. Remove construction dust and debris from boxes before installing cover plates, covers, and hoods.

3.5 PROTECTION

- A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533.16

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type ERM-C-S raceways, elbows, couplings, and nipples.
2. Type IMC raceways.
3. Type PVC raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Electrically conductive corrosion-resistant compounds for threaded conduit.
6. Solvent cements.
7. Duct accessories.
8. Handholes and boxes for exterior underground wiring.
9. Duct sealing.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" specifies nonmetallic underground conduit with conductors (Type NUCC).
3. Section 260553 "Identification for Electrical Systems" specifies underground-line warning tape and concrete cable routing markers (warning planks).

1.2 DEFINITIONS

- A. Duct: A single raceway or multiple raceways, installed singly or as components of a duct bank.
- B. Duct Bank: Two or more ducts installed in parallel, direct buried or with additional casing materials such as concrete.
- C. Handhole: An underground chamber containing electrical cables, sized such that personnel are not required to enter in order to access the cables.
- D. Manhole: An underground chamber containing electrical cables and equipment, sized to provide access with working space clearances.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.3 ACTION SUBMITTALS

- A. Shop Drawings:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Electric Utility Duct Banks and Structures:
 - a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Indicate locations of private property boundaries and utility easements.
 - c. Include information required for approval by electric utility and for obtaining public space utility work permits.
2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
 - c. Include cover design.
 - d. Include grounding details.
 - e. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and other accessories.

- B. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- B. Field Reports:
1. Factory Test Reports: For handholes and boxes.
 2. Manufacturer's field reports for field quality-control support.

1.5 REGULATORY AGENCY APPROVALS

- A. Shop Drawing submittals for electric utility duct banks and structures must be signed and sealed by qualified electrical professional engineer responsible for their preparation. Submit for action by Architect prior to submitting for approval by electric utility.
- B. Submit Shop Drawings for electric utility duct banks and structures for action by Architect prior to submitting for approval by electric utility.

PART 2 - PRODUCTS

2.1 TYPE ERM-C-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 6 and UL CCN DYIX.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Allied Tube & Conduit; Atkore International
 - b. Calconduit; Atkore International
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - e. Patriot Aluminum Products, LLC
 - f. Republic Conduit; Nucor Corporation, Nucor Tubular Products
 - g. Topaz Lighting & Electric
 - h. Western Tube; Zekelman Industries
 - i. Wheatland Tube; Zekelman Industries
 - 2. Exterior Coating: Zinc.
 - 3. Options:
 - a. Interior Coating: Zinc with organic top coating.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.2 TYPE PVC RACEWAYS AND FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 651 and UL CCN DZYR.
- B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business
 - b. Calconduit; Atkore International
 - c. JM Eagle
 - d. NAPCO; Westlake Chemical Corp.
 - e. National Pipe and Plastic, Inc. (Oldcastle)
 - f. Opti-Com Manufacturing Network, Inc (OMNI)
 - g. Topaz Lighting & Electric
 - 2. Dimensional Specifications: Schedule 40.
 - 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.

2.3 FITTINGS FOR CONDUIT, TUBING, AND CABLE

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- B. Metallic Fittings for Type ERM, and Type PVC Raceways:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. ABB, Electrification Business
 - b. Appleton; Emerson Electric Co., Automation Solutions
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector
 - d. Konkore Fittings; Atkore International
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - f. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway
 - g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - h. Southwire Company, LLC
 - i. Topaz Lighting & Electric
2. General Characteristics: UL 514B and UL CCN DWTT.
3. Options:
 - a. Material: **Steel**.
 - b. Coupling Method: Raintight compression coupling with distinctive color gland nut.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.4 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL Subject 2419 and UL CCN FOIZ.
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. ABB, Electrification Business

2.5 SOLVENT CEMENTS

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.

2.6 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. ABB, Electrification Business
- b. Allied Tube & Conduit; Atkore International
- c. Cantex Inc.
- d. IPEX USA LLC
- e. PenCell Plastics; brand of Hubbell Utility Solutions; Hubbell Incorporated
- f. Underground Devices, Inc.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. ASTM C858 for design and manufacturing processes.
 - b. SCTE 77.
- B. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover:
 - 1. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Armorcast Products Company; brand of Hubbell Utility Solutions; Hubbell Incorporated
 - b. NewBasis
 - c. Oldcastle Infrastructure Inc.; CRH Americas
 - d. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated
 - 3. Configuration: Units must be designed for flush burial and have **open** bottom unless otherwise indicated.
 - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, as indicated for each service.
 - 5. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 - 6. Duct Entrance Provisions: Duct-terminating fittings must mate with entering duct for secure, fixed installation in enclosure wall.
 - 7. Handholes 12 inch wide by 24 inch long and larger must have factory-installed inserts for cable racks and pulling-in irons.
 - 8. Options:
 - a. Color: Green.
- C. High-Density Polyethylene (HDPE) Boxes:
 - 1. Description: Injection molded of HDPE or copolymer-polypropylene. Cover must be made of **polymer concrete**.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Nordic Fiberglass, Inc
 - b. Oldcastle Infrastructure Inc.; CRH Americas

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. PenCell Plastics; brand of Hubbell Utility Solutions; Hubbell Incorporated
 - d. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated
- 3. Configuration: Units must be designed for flush burial and have open bottom unless otherwise indicated.
- 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, as indicated for each service.
- 5. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- 6. Duct Entrance Provisions: Duct-terminating fittings must be installed perpendicular to box wall and mate with entering duct for secure, fixed installation in enclosure wall without putting stress on box wall or fitting.
- 7. Options:
 - a. Color: Green.

2.8 DUCT SEALING

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. ABB, Electrification Business
 - 2. American Polywater Corporation
 - 3. CommScope, Inc
 - 4. Gardner Bender
 - 5. Ideal Industries, Inc.
 - 6. NSi Industries LLC
 - 7. TE Connectivity Ltd.
- B. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Compound must be capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.
- C. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

2.9 SOURCE QUALITY CONTROL

- A. Factory Tests for Handholes and Boxes:
 - 1. Factory Tests and Inspections: Perform the following tests and inspections on handholes and boxes, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, before delivering to site.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

Affix label with name and date of qualified testing laboratory's certification of system compliance.

- a. Precast Concrete Utility Structures: Test and inspect in accordance with ASTM C1037.
 - b. Polymer Concrete and Nonconcrete Handhole and Pull-Box Prototypes: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests must be for specified tier ratings of products supplied. Testing machine pressure gages must have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.
2. Nonconforming Work:
 - a. Equipment that does not pass tests and inspections will be considered defective.
 3. Factory Test Reports: Prepare and submit factory test and inspection reports.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to. Remove and stockpile topsoil for reapplication.

3.2 SELECTION OF UNDERGROUND DUCTS

- A. Duct for Electrical Feeders 600 V and Less: PVC-40, concrete encased unless otherwise indicated.
- B. Duct for Electrical Branch Circuits: PVC-40, direct buried unless otherwise indicated.
- C. Underground Ducts Crossing Paved Paths Walks and Driveways: PVC-40 encased in reinforced concrete.
- D. Stub-ups: Concrete encased, ERM-C-S.

3.3 SELECTION OF UNDERGROUND ENCLOSURES

- A. Handholes and Boxes:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Fiberglass enclosures with polymer concrete frame and cover, SCTE 77, Tier 15 structural load rating.
3. Units in Sidewalk and Similar Applications with Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: High-density plastic, structurally tested in accordance with SCTE 77 with 3000 lbf vertical loading.
5. Cover design load must not exceed load rating of handhole or box.

3.4 EARTHWORK

- A. Excavation and Backfill: Do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Restore area after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- E. Cut and patch existing pavement in path of underground duct, duct bank, and underground structures.

3.5 INSTALLATION OF DUCTS AND DUCT BANKS

- A. Reference Standards:
 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
 2. Consult Architect for resolution of conflicting requirements.
- B. Special Techniques:
 1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
 2. Steel raceway, bends, and fittings in on Project must be of same type.
 3. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
 4. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

5. Install expansion fitting near center of straight line duct with calculated expansion of more than 3/4 inch.
6. Curves and Bends:
 - a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch, both horizontally and vertically, at other locations unless otherwise indicated.
 - b. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of 48 inch. Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.
 - c. Duct must have maximum of 180 degrees of bends between pull points.
7. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.
 - a. Install insulated grounding bushings on steel raceway terminations that are less than 12 inch below grade or floor level and do not terminate in hubs.
8. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing duct will not be subject to environmental temperatures above 104 deg F. Where environmental temperatures are calculated to rise above 104 deg F, and anywhere duct crosses above underground steam line, install insulation blankets listed for direct burial to isolate duct bank from steam line to maintain maximum environmental temperature of 104 deg F.
9. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
10. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - a. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.
11. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig hydrostatic pressure.
12. Pulling Cord: Install 200 lbf test nylon cord in empty ducts.
13. Concrete-Encased Ducts and Duct Bank:
 - a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms for pipes 6 inch or less in nominal diameter.
 - b. Width: Excavate trench 3 inch wider than duct on each side.
 - c. Depth: Install so top of duct envelope is at least 24 inch below finished grade in areas not subject to deliberate traffic, and at least 30 inch below finished grade in deliberate traffic paths for vehicles unless otherwise indicated. Install so top of duct envelope is below local frost line.
 - d. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

- e. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - f. Minimum Space between Ducts: 3 inch between edge of duct and exterior envelope wall, 2 inch between ducts for like services, and 4 inch between power and communications ducts.
 - g. Elbows:
 - 1) Use manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct run.
 - h. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of equipment base.
 - 1) Stub-ups must be minimum 4 inch above finished floor and minimum 3 inch from conduit side to edge of slab.
 - i. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups must be minimum 4 inch above finished floor and no less than 3 inch from conduit side to edge of slab.
 - j. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - k. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - l. Concrete Cover: Install minimum of 3 inch of concrete cover between edge of duct to exterior envelope wall, 2 inch between duct of like services, and 4 inch between power and communications ducts.
 - m. Place minimum 6 inch of engineered fill above concrete encasement of duct.
 - n. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - 1) Start at one end and finish at other, allowing for expansion and contraction of duct as its temperature changes during and after pour. Use expansion fittings installed in accordance with manufacturer's published instructions, or use other specific measures to prevent expansion-contraction damage.
 - 2) If more than one pour is necessary, terminate each pour in vertical plane and install 3/4 inch reinforcing-rod dowels extending minimum of 18 inch into concrete on both sides of joint near corners of envelope.
 - o. Pouring Concrete: Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.
14. Direct-Buried Duct and Duct Bank:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms for pipes less than 6 inch in nominal diameter.
 - b. Width: Excavate trench 3 inch wider than duct on each side.
 - c. Depth: Install top of duct at least 36 inch below finished grade unless otherwise indicated.
 - d. Set elevation of top of duct bank below frost line.
 - e. Place minimum 3 inch of sand as bed for duct. Place sand to minimum of 6 inch above top level of duct.
 - f. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
 - g. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - h. Install duct with minimum of 3 inch between ducts for like services and 6 inch between power and communications duct.
 - i. Install manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct.
 - 1) Couple RNC duct to steel raceway with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete.
 - 2) Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of base. Install insulated grounding bushings on terminations at equipment.
 - a) Stub-ups must be minimum 4 inch above finished base and minimum 3 inch from conduit side to edge of base.
 - 3) Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally on exterior of wall minimum of 60 inch from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 4) Stub-ups through interior floors must be minimum 4 inch above finished floor and no less than 3 inch from conduit side to edge of equipment pad or floor slab.
 - j. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inch over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction.
15. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inch above concrete-encased duct and duct banks. Align tape parallel to and within 3 inch of centerline of duct bank. Provide additional warning tape for each 12 inch increment of duct-bank width over nominal 18 inch. Space additional tapes 12 inch apart, horizontally across width of ducts.
 16. Ground ducts and duct banks in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Reference Standards:

1. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
2. Unless otherwise indicated, support units on level bed of crushed stone or gravel, graded from 1/2 inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
4. Install handholes and boxes with bottom below frost line.
5. Field cut openings for duct in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
6. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour concrete ring encircling, and in contact with enclosure entry, and with top surface screeded to top of box cover frame. Bottom of ring must rest on compacted earth.
 - a. Concrete: 3000 psi, 28-day strength with troweled finish.
 - b. Dimensions: 10 inch wide by 12 inch deep.
7. Ground handholes and boxes in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.

B. Nonconforming Work:

1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
2. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.8 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump, and building interiors affected by Work.
 - 1. Sweep floor, removing dirt and debris.
 - 2. Remove foreign material.

END OF SECTION 260543

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Round sleeves.
 - 2. Rectangular sleeves.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Pourable sealants.
 - 7. Foam sealants.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

- A. Steel Wall Sleeves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Advance Products & Systems, LLC
 - b. CCI Piping Systems
 - c. Flexicraft Industries
 - d. GPT; a division of EnPRO Industries
 - e. Specified Technologies Inc.
 - 2. General Characteristics: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.
- B. Cast-Iron Wall Sleeves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. American Cast Iron Pipe Company
 - b. Flexicraft Industries
 - c. McWane Ductile; a part of the McWane family of companies

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. General Characteristics: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- C. PVC Pipe Sleeves:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. CCI Piping Systems
 - b. GPT; a division of EnPRO Industries
 - c. Metraflex Company (The)
 2. General Characteristics: ASTM D1785, Schedule 40.
- D. Round, Galvanized-Steel, Sheet Metal Sleeves:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Benefast
 - b. Specified Technologies Inc.
 2. General Characteristics: Galvanized-steel sheet; thickness not less than 0.0239 inch; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 RECTANGULAR SLEEVES

- A. Rectangular, Galvanized-Steel, Sheet Metal Sleeves:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Abesco Fire LLC
 - b. Specified Technologies Inc.
 - c. Wiremold; Legrand North America, LLC
 2. General Characteristics:
 - a. Material: Galvanized sheet steel.
 - b. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inch and with no side larger than 16 inch, thickness must be 0.052 inch.
 - 2) For sleeve cross-section rectangle perimeter not less than 50 inch or with one or more sides larger than 16 inch, thickness must be 0.138 inch.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Advance Products & Systems, LLC
 2. American Polywater Corporation
 3. BWM Company
 4. CALPICO, Inc.
 5. Flexicraft Industries
 6. GPT; a division of EnPRO Industries
 7. Metraflex Company (The)
 8. Proco Products, Inc

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

9. Roxtec Inc.

- B. General Characteristics: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.
- C. Options:
 - 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Holdrite; a division of Reliance Worldwide Corporation
- B. General Characteristics: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit must have plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Specified Technologies Inc.
 - 2. W. R. Meadows, Inc
- B. General Characteristics: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
 - 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 - 2. Design Mix: 5000 psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.6 POURABLE SEALANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Carlisle Syntec Systems
 - 2. GAF
 - 3. Johns Manville; a Berkshire Hathaway company
 - 4. Specified Technologies Inc.
- B. Performance Criteria:
 - 1. General Characteristics: Single-component, neutral-curing elastomeric sealants of grade indicated below.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.7 FOAM SEALANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Innovative Chemical Products (Building Solutions Group)
 2. The Dow Chemical Company
- B. Performance Criteria:
 1. General Characteristics: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway or cable, unless sleeve-seal system is to be installed or seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inch above finished floor level. Install sleeves during erection of floors.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- C. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- E. Underground, Exterior-Wall and Floor Penetrations:
 - 1. Install steel pipe sleeves. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with expanding foam without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vibration controls.
 - 2. Seismic and wind controls.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
 - 2. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers and supports referenced by this Section.

1.2 DEFINITIONS

- A. Designated Seismic System: An architectural, electrical, or mechanical system and its components for which the component importance factor is greater than 1.0 when determined in accordance with seismic requirements applicable to the Project.
- B. OSHPD: Office of Statewide Health Planning and Development (for the State of California owned and regulated medical facilities).

1.3 DELEGATED DESIGN SERVICES

- A. Delegated Design Professionals: Engage qualified structural professional engineer to design seismic and wind controls.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Prepare and submit catalog cuts, brochures, diagrams, schedules, and performance data illustrating size, physical appearance, and other characteristics of product.
 - a. Include rated load capacity for each seismic- and wind-restraint device.
 - b. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic- and wind-restraint component used.
 - c. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by an agency acceptable to authorities having jurisdiction.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 3. Show coordination of seismic and wind bracing for components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- C. Delegated Design Submittals:
 - 1. For each seismic-restraint device, including restraint - rigid and cable type, restraint accessory, and concrete anchor and insert that is required by this Section or is indicated on the Drawings, submit the following:
 - a. Seismic Restraints: Select seismic restraints complying with performance requirements, design criteria, and analysis data.
 - b. Post-Installed Concrete Anchors and Inserts: Include calculations showing anticipated seismic criteria. Include certification that device is approved by qualified testing laboratory for seismic reinforcement use.
 - c. Seismic Design Calculations: Submit input data and loading calculations.
 - 2. For each wind-restraint device, including restraint - rigid and cable type, restraint accessory, and concrete anchor and insert that is required by this Section or is indicated on the Drawings, submit the following:
 - a. Wind Restraint: Select wind restraints complying with performance requirements, design criteria, and analysis data.
 - b. Post-Installed Concrete Anchors and Inserts: Include calculations showing anticipated wind criteria. Include certification that device is approved by qualified testing laboratory for reinforcement use.
 - c. Wind Design Calculations: Submit static and dynamic loading calculations.
 - 3. Seismic- and Wind-Restraint Detail Drawings:
 - a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint details with wind details required for equipment mounted outdoors.
 - 4. Product Listing, Preapproval, and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- D. Field quality-control reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.5 REGULATORY AGENCY APPROVALS

- A. Delegated design submittals and shop drawings requiring approval by authorities having jurisdiction must be signed by qualified structural professional engineer responsible for their preparation. Submit for action by Architect prior to submitting for approval by authorities having jurisdiction.

1.6 QUALIFICATIONS

- A. Structural Professional Engineer: Professional engineer possessing active qualifications specified in Section 014000 "Quality Requirements," with expertise in structural engineering, including design of seismic and wind controls, equipment hangers and supports, and concrete foundations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Prepare design calculations in accordance with criteria specified in Section 260010 "Supplemental Requirements for Electrical" and seismic requirements applicable to the Project.
- B. Seismic and Wind Restraint Device Ratings: Devices must be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices must be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: an agency acceptable to authorities having jurisdiction.
- C. Consequential Damage: Provide additional seismic and wind restraints for suspended components or anchorage of floor-, roof-, or wall-mounted components so that failure of a non-essential or essential component will not cause failure of any other essential building component.
- D. Fire/Smoke Resistance: Seismic- and wind-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by qualified testing laboratory in accordance with ASTM E84 or UL 723, and be so labeled.
- E. Component Supports:
 - 1. Load ratings, features, and applications of reinforcement components must be based on testing standards of qualified testing laboratory.

2.2 VIBRATION CONTROLS

- A. Elastomeric Isolation Pads:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Ace Mountings Co., Inc.
 - b. CADDY; brand of nVent Electrical plc
 - c. California Dynamics Corporation
 - d. Isolation Technology, Inc
 - e. Kinetics Noise Control, Inc
 - f. Korfund
 - g. Mason Industries, Inc.
 - h. NOVIA; a division of Carpenter & Paterson
 - i. Vibration Eliminator Co., Inc
 - j. Vibration Isolation
 - k. Vibration Management Corp.
 - l. VMC GROUP
2. Standard Features:
 - a. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - b. Size: Factory or field cut to match requirements of supported equipment.
 - c. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
 - d. Surface Pattern: Smooth, ribbed, or waffle pattern.
 - e. Infused nonwoven cotton or synthetic fibers.
 - f. Load-bearing metal plates adhered to pads.

2.3 SEISMIC AND WIND CONTROLS

- A. Restraints - Rigid Type:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Atkore Unistrut
 - b. CADDY; brand of nVent Electrical plc
 - c. California Dynamics Corporation
 - d. Cooper B-line; brand of Eaton, Electrical Sector
 - e. Hilti, Inc.
 - f. Isolation Technology, Inc
 - g. TOLCO Incorporated
 - h. VMC GROUP
 2. Standard Features: Shop- or field-fabricated bracing assembly made of ANSI/AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.
- B. Restraints - Cable Type:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. CADDY; brand of nVent Electrical plc
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. Gripple Inc.
 - d. Loos & Co. Inc.
 - e. VMC GROUP

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Standard Features:
 - a. Seismic- and Wind-Restraint Cables: ASTM A1023/A1023M galvanized or ASTM A603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket, or mechanical (Flemish eye) loop.
 - b. Restraint cable assembly and cable fittings must comply with ASCE/SEI 19. Cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.
- C. Restraint Accessories:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Atkore Unistrut
 - b. CADDY; brand of nVent Electrical plc
 - c. Cooper B-line; brand of Eaton, Electrical Sector
 - d. Hilti, Inc.
 - e. Loos & Co. Inc.
 - f. Mason Industries, Inc.
 - g. TOLCO Incorporated
 2. Standard Features:
 - a. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Non-metallic stiffeners are unacceptable.
 - b. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
 - c. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
 - d. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
 - e. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- D. Mechanical Anchor Bolts:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Atkore Unistrut
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. Hilti, Inc.
 - d. Mason Industries, Inc.
 - e. Powers Fasteners
 2. Standard Features:
 - a. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
 - b. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.
- E. Adhesive Anchor Bolts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Atkore Unistrut
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. Hilti, Inc.
 - d. Mason Industries, Inc.
 - e. Powers Fasteners
 - 2. Standard Features
 - a. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
 - b. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - c. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.
- F. Concrete Inserts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Atkore Unistrut
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. Hilti, Inc.
 - d. Mason Industries, Inc.
 - e. Powers Fasteners
 - 2. Standard Features:
 - a. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC446 testing.
 - b. Comply with MSS SP-58.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.2 SELECTION OF VIBRATION AND SEISMIC CONTROLS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on the Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static, wind, and seismic loads within specified loading limits.

3.3 INSTALLATION OF SEISMIC AND WIND CONTROLS

- A. Provide seismic and wind control devices for systems and equipment where indicated in Equipment Schedules or Seismic and Wind Controls Schedule, where indicated on the Drawings, where the Specifications indicate they must be installed on specific equipment and systems, and where required by applicable codes.
 - 1. Install equipment and devices to withstand the effects of earthquake motions and high wind events.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork.
- C. Installation of seismic and wind restraints must not cause any stresses, misalignment, or change of position of equipment or conduits.
- D. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 2. Install seismic-restraint and wind-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Raceway, Cable, and Wireway Support and Hanger Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 2. Install seismic-restraint and wind-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
 - 3. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 4. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Post-Installed Concrete Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Mechanical-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors must be installed with sleeve fully engaged in the structural element to which anchor will be fastened.
 - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.
- J. Accommodation of Differential Seismic Motion: Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by authorities having jurisdiction.
- B. Special Structural Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test no fewer than four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
- C. Nonconforming Work:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Seismic controls will be considered defective if they do not pass tests and inspections.
 2. Remove and replace malfunctioning units and retest as specified above.
- D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

END OF SECTION 260548

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Labels.
 - 2. Extruded insulating tubing.
 - 3. Bands.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 LABELS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.
- B. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Champion America

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- c. emedco
 - d. Grafoplast Wire Markers
 - e. HellermannTyton
 - f. LEM Products Inc.
 - g. Marking Services Inc.
 - h. Panduit Corp
 - i. Seton Identification Products; a Brady Corporation company
- C. UL PGDQ2 - Self-Adhesive Wraparound Labels: Preprinted, 3 mil thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A'n D Cable Products
 - b. Brady Corporation
 - c. Brother International Corporation
 - d. emedco
 - e. Grafoplast Wire Markers
 - f. Ideal Industries, Inc.
 - g. LEM Products Inc.
 - h. Marking Services Inc.
 - i. Panduit Corp
 - j. Seton Identification Products; a Brady Corporation company
 - 2. Self-Lamination: Clear; UV-, weather-, and chemical-resistant; self-laminating, with protective shield over legend. Size labels such that clear shield overlaps entire printed legend.
 - 3. Marker for Labels:
 - a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. UL PGDQ2 - Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A'n D Cable Products
 - b. Brady Corporation
 - c. Brother International Corporation
 - d. emedco
 - e. Grafoplast Wire Markers
 - f. HellermannTyton
 - g. Ideal Industries, Inc.
 - h. LEM Products Inc.
 - i. Marking Services Inc.
 - j. Panduit Corp
 - k. Seton Identification Products; a Brady Corporation company
 - 2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inch for raceway and conductors.
 - b. 3-1/2 by 5 inch for equipment.
 - c. As required by authorities having jurisdiction.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2.2 EXTRUDED INSULATING TUBING

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN YDPU2 for components; including UL 224.
- B. UL YDPU2 - Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Panduit Corp

2.3 BANDS

- A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. HellermannTyton
 - c. Marking Services Inc.
 - d. Panduit Corp
 - e. Seton Identification Products; a Brady Corporation company
- B. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch long, with diameters sized to suit diameters and that stay in place by gripping action.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. HellermannTyton
 - c. Marking Services Inc.
 - d. Panduit Corp

2.4 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. Champion America
 - d. HellermannTyton

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- e. Ideal Industries, Inc.
 - f. Marking Services Inc.
 - g. Panduit Corp
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil thick by 1 to 2 inch wide; compounded for outdoor use.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. emedco
 - d. Marking Services Inc.
- C. Tape and Stencil: 4 inch wide black stripes on 10 inch centers placed diagonally over orange background and are 12 inch wide. Stop stripes at legends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HellermannTyton
 - b. LEM Products Inc.
 - c. Marking Services Inc.
 - d. Pipemarker.com; Brimar Industries, Inc.
 - e. Seton Identification Products; a Brady Corporation company
- D. Floor Marking Tape: 2 inch wide, 5 mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. Seton Identification Products; a Brady Corporation company
- E. Underground-Line Warning Tape:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Ideal Industries, Inc.
 - c. LEM Products Inc.
 - d. Marking Services Inc.
 - e. Pipemarker.com; Brimar Industries, Inc.
 - f. Reef Industries, Inc.
 - g. Seton Identification Products; a Brady Corporation company
 - 2. Tape:
 - a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical **[and communications]**utility lines.
 - b. Printing on tape must be permanent and may not be damaged by burial operations.
 - c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 3. Color and Printing:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
- b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".
- c. Inscriptions for Orange Tapes: "CAUTION BURIED COMMUNICATION LINE BELOW".
- 4. Reinforced Detectable Line-Warning Tape :
 - a. Reinforced, detectable three-layer laminate, consisting of printed pigmented woven scrim, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright-colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
 - b. Width: 3 inch.
 - c. Overall Thickness: 8 mil.
 - d. Foil Core Thickness: 0.35 mil.
 - e. Weight: 34 lb/1000 sq. ft.
 - f. Tensile in accordance with ASTM D882: 300 lbf and 12,500 psi.
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height must be 1 inch.

2.5 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. emedco
 - d. Marking Services Inc.
 - e. Seton Identification Products; a Brady Corporation company
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. emedco
 - d. Grafoplast Wire Markers
 - e. LEM Products Inc.
 - f. Marking Services Inc.
 - g. Panduit Corp
 - h. Seton Identification Products; a Brady Corporation company
- C. Write-on Tags:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Carlton Industries, LP
 - c. LEM Products Inc.
 - d. Pipemarket.com; Brimar Industries, Inc.
 - e. Seton Identification Products; a Brady Corporation company
- 2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
- 3. Marker for Tags:
 - a. .
 - b. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.6 SIGNS

- A. Baked-Enamel Signs:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Champion America
 - c. emedco
 - d. Marking Services Inc.
 - 2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 3. 1/4 inch grommets in corners for mounting.
 - 4. Nominal Size: 7 by 10 inch.
- B. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. emedco
 - d. Marking Services Inc.
 - e. Seton Identification Products; a Brady Corporation company
 - 2. Engraved legend.
 - 3. Thickness:
 - a. For signs up to 20 sq. inch, minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. inch, 1/8 inch thick.
 - c. Engraved legend with white letters on dark gray background.
 - d. Self-adhesive.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. HellermannTyton
 - 2. Ideal Industries, Inc.
 - 3. Marking Services Inc.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Panduit Corp
- B. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.
- C. UL ZODZ - General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- D. UL ZODZ - UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.
- E. UL ZODZ - Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:
 1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.
 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft above finished floor.
- B. Pipe and Conduit Labeling: Comply with ASME A13.1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - 1. Color must be factory applied or field applied for sizes larger than 6 AWG when permitted by authorities having jurisdiction.
 - 2. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Color for Neutral (Grounded Conductor): White.
 - 5. Color for Equipment Ground: Green.
 - 6. Color for Isolated Ground: Green with two or more yellow stripes. Raceways, Cable Trays, Junction Boxes, and Conductors for Intrinsically-Safe Circuits: Light blue. When used to identify intrinsically-safe circuits, Article 504 of NFPA 70 requires that the color light blue not be used for any other purpose.
- D. Color-Coding Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- E. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
- F. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- G. Locations of Underground Lines: Underground-line warning tape for power and lighting.
- H. Handholes, and Pull and Junction Boxes, 1000 V or Less: For conductors in pull and junction boxes, handholes, use self-adhesive wraparound labels to identify phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
 - 2. Identify system voltage and system or service type with black letters on orange field.
- I. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:
 - 1. Panelboard designation.
 - 2. Colon or dash.
 - 3. Branch circuit number.
- J. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- K. Equipment Identification Labels:
 - 1. Black letters on white field.
 - 2. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 3. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 4. Equipment to Be Labeled:
 - a. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels.
 - b. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved, laminated acrylic or melamine label.
 - c. Enclosures and electrical cabinets.
 - d. Access doors and panels for concealed electrical items.
 - e. Emergency system boxes and enclosures.
 - f. Enclosed switches.
 - g. Enclosed circuit breakers.
 - h. Enclosed controllers.
 - i. Variable-speed controllers.
 - j. Push-button stations.
 - k. Power-transfer equipment.
 - l. Contactors.
 - m. Remote-controlled switches, dimmer modules, and control devices.
 - n. Power-generating units.
 - o. Monitoring and control equipment.
- L. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 SELECTION OF SIGNS AND HAZARD MARKINGS

- A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.
- B. Signs, labels, and tags required for personnel safety must comply with the following standards:
 - 1. Safety Colors: NEMA Z535.1.
 - 2. Facility Safety Signs: NEMA Z535.2.
 - 3. Safety Symbols: NEMA Z535.3.
 - 4. Product Safety Signs and Labels: NEMA Z535.4.
 - 5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.
- C. Electrical Hazard Warnings:
 - 1. Arc-Flash Hazard Warning: Self-adhesive labels. Comply with NFPA 70E and [Section 260573 "Power System Studies" requirements for arc-flash hazard warning labels.
 - 2. Multiple Power Sources Warning Legend: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 3. OSHA Workspace Clearance Warning Legend: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- E. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.
- F. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on red background with minimum 3/8 inch high letters for emergency instructions at equipment used for power transfer.

3.4 SELECTION OF IDENTIFICATION PRODUCTS FOR COMMUNICATIONS, CONTROL, AUXILIARY, AND LIFE SAFETY SYSTEMS

- A. Comply with Section 270528 "Pathways for Communications Systems."

3.5 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes typical for electrical equipment environments specified in Section 260010 "Supplemental Requirements for Electrical."
- C. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- D. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.
- E. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- F. Install identifying devices before installing acoustical ceilings and similar concealment.
- G. Verify identity of item before installing identification products.
- H. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- I. Apply identification devices to surfaces that require finish after completing finish work.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- J. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- L. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- M. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.
- N. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.
- O. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.
- P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.
- R. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.
- U. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape not less than 12 inch directly above cables or raceways buried 18 inch or more below grade. Use multiple tapes where width of multiple lines installed in common trench or concrete envelope exceeds 16 inch overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- V. Metal Tags:
 - 1. Place in location with high visibility and accessibility.
 - 2. Secure using cable ties.
- W. Nonmetallic Preprinted Tags:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Place in location with high visibility and accessibility.
 2. Secure using cable ties.
- X. Write-on Tags:
1. Place in location with high visibility and accessibility.
 2. Secure using cable ties.
- Y. Baked-Enamel Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
- Z. Metal-Backed Butyrate Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
- AA. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION 260553

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260573 - POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section Includes:
 - 1. Short-circuit study.
 - 2. Overcurrent protective device coordination study.
 - 3. Arc-flash hazard study.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.

1.2 DEFINITIONS

- A. Digital Twin: The digital representation of a real-world entity, concept, or notion, either physical or perceived.

1.3 ACTION SUBMITTALS

- A. Product Data: For power system analysis software to be used for studies.
 - 1. Product Certificates: For power system study software applications, include certificate stating compliance with specified requirements, signed by software manufacturer.
- B. Power System Study Reports:
 - 1. Submit reports after approval of system protective devices submittals. Submittals must be in digital form.
 - 2. Submit short-circuit study input data, including completed computer-program input data sheets.
 - 3. Submit coordination study input data, including completed computer-program input data sheets.
 - a. Submit load-flow, voltage-drop, and motor-starting data with coordination study.
 - 4. Submit arc-flash study input data, including completed computer-program input data sheets.
 - 5. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
 - 6. Submit revised one-line diagram, reflecting field investigation results and results of short-circuit study.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Data files for studies in format compatible with Owner's power system analysis software.

1.4 QUALITY ASSURANCE

- A. Submittals for power system studies must be signed and sealed by qualified electrical professional engineer responsible for their preparation.
- B. Studies must be performed using commercially developed and distributed software designed specifically for power system analysis.
- C. Software algorithms must comply with requirements of standards and guides specified in this Section.
- D. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CYME International T&D Inc.; subsidiary of Eaton Corporation plc
 - 2. EasyPower; brand of Bentley Systems, Inc.
 - 3. ETAP; brand of Operation Technology, Inc.; subsidiary of Schneider Electric
 - 4. Paladin DesignBase; brand of Bentley Systems, Inc.
 - 5. Power Tools for Windows (PTW); brand of SKM Systems Analysis, Inc.
- B. Standard Features:
 - 1. Power System Analysis:
 - a. Power-systems-analysis software applications must have analytical capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 3002 series standards.
 - b. Computer software application must be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program must report device settings and ratings of overcurrent protective devices and must demonstrate selective coordination by computer-generated, time-current coordination plots.
 - c. Computer software application must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.
 - 2. Analysis Standards:
 - a. Short-Circuit Current Analysis: In accordance with IEEE 3002.3.
 - b. Device Coordination Analysis: In accordance with IEEE 3004.3 and IEEE 3004.5.
 - c. Load-Flow Analysis: In accordance with IEEE 3002.2.
 - d. Motor-Starting Analysis: In accordance with IEEE 3002.7.
 - e. Harmonic Analysis: In accordance with IEEE 3002.8.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- f. Transient Stability Analysis: In accordance with IEEE P3002.9.
 - g. Arc-Flash Hazard Analysis: In accordance with IEEE 1584.
 - 3. Capable of printing arc-flash hazard warnings for equipment on vinyl, weather- and UV-resistant, pressure-sensitive adhesive labels complying with NFPA 70E.
 - a. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard study:
 - 1) Equipment designation.
 - 2) Nominal voltage.
 - 3) Protection boundaries.
 - a) Arc-flash boundary.
 - b) Restricted approach boundary.
 - c) Limited approach boundary.
 - 4) Arc-flash PPE category.
 - 5) Required minimum arc rating of PPE in Cal/cm squared.
 - 6) Available incident energy.
 - 7) Working distance.
 - 8) Engineering report number, revision number, and issue date.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Collect and analyze data for power system studies.
 - 1. Verify completeness of data supplied in one-line diagram on Drawings. Call discrepancies to Architect's attention.
 - 2. For equipment included as Work on the Project, use characteristics submitted under provisions of action submittals and information submittals for the Project.
 - 3. Forequipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers in accordance with NFPA 70E.
 - 4. Gather and tabulate required input data to support power system studies. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on Record Document copy of one-line diagram. Comply with recommendations in IEEE 3002 series standards as to amount of detail that is required to be acquired in field. Field data gathering must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:
 - a. Product data for the Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - b. Electrical power utility impedance at service.
 - c. Power sources and ties.
 - d. Short-circuit current at each system bus (three phase and line to ground).
 - e. Full-load current of loads.
 - f. Voltage level at each bus.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- g. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
- h. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
- i. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
- j. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
- k. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
- l. Maximum demands from service meters.
- m. Motor horsepower and NEMA MG 1 code letter designation.
- n. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
- o. Derating factors.

3.2 PREPARATION

A. Preparation of Data for Short-Circuit Study:

- 1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Architect's attention.
- 2. For equipment included as Work on the Project, use characteristics submitted under provisions of action submittals and information submittals for the Project.
- 3. Prepare one-line diagram of modeled power system, showing the following:
 - a. Protective device designations and ampere ratings.
 - b. Conductor types, sizes, and lengths.
 - c. Transformer kVA and voltage ratings.
 - d. Motor and generator designations and kVA ratings.
 - e. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
 - f. Derating factors and environmental conditions.
 - g. Revisions to electrical equipment required by study.

B. Preparation of Data for Overcurrent Protective Device Coordination Study:

- 1. Prepare data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, indicating the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.
 - e. Ratings, types, and settings of utility company's overcurrent protective devices.
 - f. Special overcurrent protective device settings or types stipulated by utility company.
 - g. Time-current-characteristic curves of devices indicated to be coordinated.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
 - k. Identify series-rated interrupting devices for condition where available fault current is greater than interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.
 - 2. Examine the Project's overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
 - 3. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.
- C. Preparation of Data for Arc-Flash Hazard Study:
- 1. Assemble data from short-circuit study and overcurrent protective device coordination study.
 - 2. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.3 SHORT-CIRCUIT STUDY

- A. Base study on device characteristics supplied by device manufacturer.
- B. Extent of electrical power system to be studied is indicated on Drawings.
- C. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- D. Include AC fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase AC systems. Also account for fault-current DC decrement to address asymmetrical requirements of interrupting equipment.
- E. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at equipment indicated on one-line diagram.
 - 1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.
- F. Include in report identification of protective device applied outside its capacity.

3.4 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

- A. Base study on device characteristics supplied by device manufacturer.
- B. electrical power system to be studied is indicated on Drawings.
- C. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- D. Transformer Primary Overcurrent Protective Devices:
 - 1. Device must not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads in accordance with IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings must protect transformers in accordance with IEEE C57.12.00, for fault currents.
- E. Motor Protection:
 - 1. Select protection for low-voltage motors in accordance with IEEE 3004.8 and NFPA 70.
 - 2. Select protection for motors served at voltages more than 600 V in accordance with IEEE 620.
- F. Conductor Protection: Protect cables against damage from fault currents in accordance with ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 3004.7. Demonstrate that equipment withstands maximum short-circuit current for time equivalent to tripping time of primary relay protection or total clearing time of fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- G. Generator Protection: Select protection in accordance with manufacturer's published instructions and IEEE C37.102.
- H. Include AC fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase AC systems. Also account for fault-current DC decrement, to address asymmetrical requirements of interrupting equipment.
- I. Include coordination of ground-fault protection devices.
- J. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at equipment indicated on one-line diagram.
 - 1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.
- K. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short-circuit ratings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Include in report identification of protective device applied outside its capacity.

3.5 ARC-FLASH HAZARD STUDY

- A. Comply with NFPA 70E, including Annex D, for arc-flash hazard study.
- B. Preparatory Studies: Obtain short-circuit study and overcurrent protective device coordination study results prior to starting arc-flash hazard study.
- C. Calculate maximum and minimum contributions of fault-current size.
 1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current in accordance with IEEE 1584 recommendations.
 3. Calculate arc-flash energy at 38 percent of maximum short-circuit current in accordance with NFPA 70E recommendations.
 4. Calculate arc-flash energy with utility contribution at minimum and assume no motor contribution.
- D. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations.
- F. Calculate limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must account for changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:
 1. Fault contribution from induction motors must not be considered beyond three to five cycles.
 2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).
- H. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:
 1. When circuit breaker is in separate enclosure.
 2. When line terminals of circuit breaker are separate from work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.6 POWER SYSTEM STUDY REPORTS

- A. Preparation of Power System Study Reports: Prepare and submit the following:
1. Short-Circuit Study Report Contents:
 - a. Executive summary of study findings.
 - b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
 - c. One-line diagram of modeled power system, showing the following:
 - 1) Protective device designations and ampere ratings.
 - 2) Conductor types, sizes, and lengths.
 - 3) Transformer kVA and voltage ratings.
 - 4) Motor and generator designations and kVA ratings.
 - 5) Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
 - 6) Derating factors and environmental conditions.
 - 7) Revisions to electrical equipment required by study.
 - d. Comments and recommendations for system improvements or revisions in written document, separate from one-line diagram.
 - e. Short-Circuit Study Input Data:
 - 1) One-line diagram of system being studied.
 - 2) Power sources available.
 - 3) Manufacturer, model, and interrupting rating of protective devices.
 - 4) Conductors.
 - 5) Transformer data.
 - f. Protective Device Evaluation:
 - 1) Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
 - 2) Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
 - 3) For 600 V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 4) For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
 - 5) Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - g. Short-Circuit Study Output Reports:
 - 1) Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a) Voltage.
 - b) Calculated fault-current magnitude and angle.
 - c) Fault-point X/R ratio.
 - d) Equivalent impedance.

- 2) Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a) Voltage.
 - b) Calculated symmetrical fault-current magnitude and angle.
 - c) Fault-point X/R ratio.
 - d) Calculated asymmetrical fault currents based on fault-point X/R ratio; based on calculated symmetrical value multiplied by 1.6; and based on calculated symmetrical value multiplied by 2.7.
 - 3) Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a) Voltage.
 - b) Calculated symmetrical fault-current magnitude and angle.
 - c) Fault-point X/R ratio.
 - d) No AC Decrement (NACD) ratio.
 - e) Equivalent impedance.
 - f) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
 - g) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.
2. Overcurrent Protection Device Coordination Study Report Contents:
 - a. Executive summary of study findings.
 - b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
 - c. One-line diagram of modeled power system, showing the following:
 - 1) Protective device designations and ampere ratings.
 - 2) Conductor types, sizes, and lengths.
 - 3) Transformer kVA and voltage ratings.
 - 4) Motor and generator designations and kVA ratings.
 - 5) Switchgear, switchboard, motor-control center, and panelboard designations.
 - 6) Revisions to electrical equipment required by study.
 - d. Report recommended settings of protective devices, ready to be applied in field. Use manufacturer's data sheets for recording recommended setting of overcurrent protective devices when available.
 - 1) Phase and Ground Relays:
 - a) Device tag.
 - b) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - c) Recommendations on improved relaying systems, if applicable.
 - 2) Circuit Breakers:
 - a) Adjustable pickups and time delays (long time, short time, and ground).
 - b) Adjustable time-current characteristic.
 - c) Adjustable instantaneous pickup.
 - d) Recommendations on improved trip systems, if applicable.
 - 3) Fuses: Show current rating, voltage, and class.
 - e. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series,

including power utility company's upstream devices. Prepare separate sets of curves for switching schemes and for emergency periods where power source is local generation. Show the following information:

- 1) Device tag and title, one-line diagram with legend identifying portion of system covered.
 - 2) Terminate device characteristic curves at point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
 - 3) Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
 - 4) Plot the following listed characteristic curves, as applicable:
 - a) Power utility's overcurrent protective device.
 - b) Medium-voltage equipment overcurrent relays.
 - c) Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - d) Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - e) Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - f) Cables and conductors damage curves.
 - g) Ground-fault protective devices.
 - h) Motor-starting characteristics and motor damage points.
 - i) Generator short-circuit decrement curve and generator damage point.
 - j) Largest feeder circuit breaker in each motor-control center and panelboard.
 - 5) Maintain selectivity for tripping currents caused by overloads.
 - 6) Provide adequate time margins between device characteristics such that selective operation is achieved.
 - 7) Comments and recommendations for system improvements.
3. Arc-Flash Hazard Study Report Contents:
- a. Executive summary of study findings.
 - b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
 - c. One-line diagram, showing the following:
 - 1) Protective device designations and ampere ratings.
 - 2) Conductor types, sizes, and lengths.
 - 3) Transformer kVA and voltage ratings, including derating factors and environmental conditions.
 - 4) Motor and generator designations and kVA ratings.
 - 5) Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
 - d. Short-circuit study output data.
 - e. Overcurrent protective device coordination study report contents.
 - f. Arc-Flash Study Output Reports:
 - 1) Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:
 - a) Voltage.
 - b) Calculated symmetrical fault-current magnitude and angle.
 - c) Fault-point X/R ratio.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d) No AC Decrement (NACD) ratio.
- e) Equivalent impedance.
- f) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
- g) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.
- g. Incident Energy and Flash Protection Boundary Calculations:
 - 1) Arcing fault magnitude.
 - 2) Protective device clearing time.
 - 3) Duration of arc.
 - 4) Arc-flash boundary.
 - 5) Restricted approach boundary.
 - 6) Limited approach boundary.
 - 7) Working distance.
 - 8) Incident energy.
 - 9) Hazard risk category.
 - 10) Recommendations for arc-flash energy reduction.
- h. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.

3.7 FIELD ADJUSTMENT FOR DEVICE COORDINATION

- A. Adjust relay and protective device settings in accordance with recommended settings provided by coordination study. Field adjustments must be completed by engineering service division of equipment manufacturer under "Startup and Acceptance Testing" contract portion.
- B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.
- C. Testing and adjusting must be by qualified low-voltage electrical testing and inspecting agency.

3.8 WARNING LABELING OF ARC-FLASH HAZARDS

- A. Apply arc-flash label on front cover for each equipment included in study, including each piece of equipment listed below:
 - 1. .
 - 2. Panelboards.
 - 3. Safety switches.
 - 4. Control panels.
- B. Base arc-flash label data on highest values calculated at each location.
- C. Machine print warning labels with no handwritten or field-applied markings.
- D. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. Indicate on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.
 - 1. Indicate arc-flash energy.
 - 2. Indicate protection level required.

END OF SECTION 260573

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches.
 - 3. Business occupancy and vacancy sensors.
 - 4. Industrial control switches.
 - 5. Emergency lighting controls.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
 - 2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding of lighting control devices referenced by this Section.
 - 3. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers and supports referenced by this Section.
 - 4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
 - 5. Section 262726 "Wiring Devices" for wall-box dimmers and manual light switches.

1.2 DEFINITIONS

- A. BCELTS: Branch circuit emergency lighting transfer switch.
- B. DPDT: Double pole double throw.
- C. DPST: Double pole single throw.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. PIR: Passive infrared.
- G. SPDT: Single pole double throw.
- H. SPST: Single pole single throw.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
 - b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
 - c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.
- B. Shop Drawings: Prepare and submit the following:
 - 1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Diagrams for power, signal, and control wiring.
- C. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.
- B. Field Reports:
 - 1. Manufacturer's field reports for field quality-control support.
 - 2. Field reports for software and firmware upgrades.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.6 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures, conduct tests of complex equipment, analyze test and equipment data, plan a job, and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems; evaluate tests, test equipment, test results, and power system performance; recommend actions to maintain or improve system performance; and lead multiteam projects.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from qualified electrical testing laboratory recognized by authorities having jurisdiction.
 - 1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.
- D. Lighting Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing and inspecting lighting installations in accordance with applicable IES standards.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements:
 - 1. Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Must comply with CCR Title 24.

2.2 TIME SWITCHES

- A. UL WGZR - Electronic Time Switch:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton
 - b. Intermatic, Inc
 - c. Leviton Manufacturing Co., Inc.
 - d. nLight; Acuity Brands Lighting, Inc.
 - e. NSi Industries LLC
 - f. Schneider Electric USA, Inc.
 - g. TE Connectivity Ltd.
 - h. Touché Lighting Control
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Clock-Operated Switches: UL CCN WGZR, including UL 917.
 - 4. Standard Features:
 - a. Contact Configuration: SPST.
 - b. Contact Rating: 20 A driver load, 120/240 V(ac).
 - c. Programs:
 - 1) Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
 - d. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
 - e. Astronomic Time: All channels.
 - f. Automatic daylight savings time changeover.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- g. Battery Backup: Not less than seven days' reserve, to maintain schedules and time clock.
- B. UL WGZR - Digital Timer Light Switch:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton
 - b. Intermatic, Inc
 - c. Leviton Manufacturing Co., Inc.
 - d. nLight; Acuity Brands Lighting, Inc.
 - e. NSi Industries LLC
 - f. Schneider Electric USA, Inc.
 - g. TE Connectivity Ltd.
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Clock-Operated Switches: UL CCN WGZR, including UL 917.
 - 4. Standard Features:
 - a. Combination digital timer and conventional switch lighting control unit. Switchbox-mounted, backlit LCD display, with selectable time interval in 20-minute increments.
 - b. Rated 960 W at 120 V(ac) for tungsten lighting, 10 A at 120 V(ac) or 10 A at 277 V(ac) for fluorescent or LED lighting, and 1/4 hp at 120 V(ac).
 - c. Standards: Comply with UL 20.
 - d. Integral relay for connection to BAS.
 - e. Voltage: 120 V.
 - f. Color: White.
 - g. Faceplate: Color matched to switch.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

- A. UL WJFX - Solid-State, Low-Voltage, Outdoor Photoelectric Switch:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton
 - b. Intermatic, Inc
 - c. Leviton Manufacturing Co., Inc.
 - d. nLight; Acuity Brands Lighting, Inc.
 - e. NSi Industries LLC
 - f. TE Connectivity Ltd.
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Plug-in, Locking-Type Photocontrols: UL CCN WJFX, including UL 773.
 - 4. Standard Features:
 - a. Solid state; one set of N.O. dry contacts rated for 24 V(ac) at 1 A, to operate connected load, and compatible with power pack.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
- c. Time Delay: Thirty-second minimum, to prevent false operation.
- d. Mounting: 1/2 inch threaded male conduit.
- e. Failure Mode: Luminaire stays ON.
- f. Power Pack:
 - 1) Dry contacts rated for 20 A driver or LED load at 120 and 277 V(ac), for 13 A tungsten at 120 V(ac), and for 1 hp at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.
 - a) LED status lights to indicate load status.
 - b) Plenum rated.
 - 2) Digital controller capable of accepting three 8PSJ inputs with one outputs rated for 20 A incandescent or LED load at 120 and 277 V(ac), for 16 A driver or LED at 120 and 277 V(ac), and for 1 hp at 120 V(ac). Sensor has 24 V(dc), Class 2 power source.
 - a) With integral current monitoring.
 - b) Compatible with digital addressable lighting interface.
 - c) Plenum rated.

2.4 BUSINESS OCCUPANCY AND VACANCY SENSORS

- A. Dual-Technology, Passive-Infrared (PIR) and Ultrasonic, Occupancy or Vacancy Sensor:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Lighting Solutions; Signify North America Corp.
 - b. HLI Solutions; brand of GE Current, a Daintree Company
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for one of the following UL product categories:
 - a. Energy Management Equipment: UL CCN PAZX, including UL 916 or UL 60730-1.
 - b. Appliance Controls: UL CCN ATNZ, including UL 60730-1.
 - c. Intrusion Detection Units: UL CCN ANSR, including UL 639.
 - 4. Standard Features:
 - a. Wall or ceiling-mounted, solid-state indoor occupancy or vacancy sensors.
 - b. Separate power pack.
 - c. Hardwired connection to switch.
 - d. Sensitivity Adjustment: Separate for each sensing technology.
 - e. Detector Sensitivity: Detect occurrences of 6 inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch, and detect a person of average size and weight moving not less than 12 inch in either a horizontal or a vertical manner at an approximate speed of 12 inch/s.
 - 1) Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft when mounted on a 96 inch high ceiling.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- 2) Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 sq. ft when mounted 48 inch above finished floor.
 5. Operation:
 - a. Combination Sensor: Unless otherwise indicated, sensor must be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
- B. Dual-Technology, Passive-Infrared (PIR) and Passive-Acoustic, Occupancy or Vacancy Sensor:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HLI Solutions; brand of GE Current, a Daintree Company
 - b. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - c. SensorWorx; brand of BLP Technologies, Inc.
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for one of the following UL product categories:
 - a. Energy Management Equipment: UL CCN PAZX, including UL 916 or UL 60730-1.
 - b. Appliance Controls: UL CCN ATNZ, including UL 60730-1.
 - c. Intrusion Detection Units: UL CCN ANSR, including UL 639.
 4. Standard Features:
 - a. Wall or ceiling-mounted, solid-state indoor occupancy or vacancy sensors.
 - b. Separate power pack.
 - c. Hardwired connection to switch.
 - d. Sensitivity Adjustment: Separate for each sensing technology.
 - e. Detector Sensitivity: Detect occurrences of 6 inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch, and detect a person of average size and weight moving not less than 12 inch in either a horizontal or a vertical manner at an approximate speed of 12 inch/s.
 - 1) Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft when mounted on a 96 inch high ceiling.
 - 2) Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 sq. ft when mounted 48 inch above finished floor.
 5. Operation:
 - a. Combination Sensor: Unless otherwise indicated, sensor must be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
- C. Wall-Switch Occupancy Sensor:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Bryant; brand of Hubbell Electrical Solutions; Hubbell Incorporated
- b. Douglas Lighting Controls
- c. Eaton
- d. Hubbell Control Solutions; brand of Hubbell Electrical Solutions; Hubbell Incorporated
- e. Intermatic, Inc
- f. Leviton Manufacturing Co., Inc.
- g. Lithonia Lighting; Acuity Brands Lighting, Inc.
- h. Lutron Electronics Co., Inc
- i. nLight; Acuity Brands Lighting, Inc.
- j. NSi Industries LLC
- k. Philips; Signify North America; Signify Holding
- l. RAB Lighting
- m. Sensor Switch, Inc
- n. Square D; Schneider Electric USA
- o. WattStopper; Legrand North America, LLC
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for one of the following UL product categories:
 - a. Photoelectric Controls: UL CCN WJCT, including UL 773A.
 - b. Energy Management Equipment: UL CCN PAZX, including UL 916 or UL 60730-1.
 - c. Intrusion Detection Units: UL CCN ANSR, including UL 639.
4. Standard Features:
 - a. Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in single gang switchbox using hardwired connection.
 - 1) Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 2) Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 - 3) Switch Rating: Not less than 800 VA driver or LED load at 120 V, 1200 VA driver or LED load at 277 V, and 800 W incandescent.
 - b. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
 - c. Sensing Technology: Dual technology - PIR and ultrasonic.
 - d. Switch Type: Single pole, field-selectable automatic "on," or manual "on," automatic "off."
 - e. Capable of controlling load in three-way application.
 - f. Voltage: 120 V.
 - g. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. Switch prevents lights from turning on when light level is higher than set point of sensor.
 - h. Time Delay:
 - 1) Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 - i. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
 - j. Color: White.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- k. Faceplate: Color matched to switch.

2.5 INDUSTRIAL CONTROL SWITCHES

A. Lighting Contactor:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business
 - b. Allen-Bradley/Rockwell Automation
 - c. ASCO Power Technologies
 - d. Eaton
 - e. Leviton Manufacturing Co., Inc.
 - f. Square D; Schneider Electric USA
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Industrial Control Switches: UL CCN NRNT, including UL 508.
4. Standard Features:
 - a. Electrically operated and mechanically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2.
 - b. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush driver (driver with 15 percent or less THD of normal load current).
 - c. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - d. Enclosure Rating: Comply with UL 50E.
 - e. Provide with control and pilot devices as indicated on the Drawings, matching the enclosure rating specified for the enclosure.

2.6 EMERGENCY LIGHTING CONTROLS

A. UL FTBR - Automatic Load Control Relay:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bodine; Signify North America; Signify Holding
 - b. Chloride; Signify North America; Signify Holding
 - c. HLI Solutions; brand of GE Current, a Daintree Company
 - d. Intelligent Lighting Controls Inc.
 - e. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - f. nLight; Acuity Brands Lighting, Inc.
 - g. WattStopper; Legrand North America, LLC
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Emergency Lighting and Power Equipment: UL CCN FTBR, including UL 924.
4. Standard Features:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. N.C., electrically held relay.
- b. Coil Rating: 120 V.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 INSTALLATION OF LIGHTING CONTROL DEVICES

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
 - 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Electrical Maintenance: NFPA 70B.
 - 3. Electrical Safety: NFPA 70E.
 - 4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 - 5. Communications Work: BICSI N1.
 - 6. Life Safety and Means of Egress Work: NFPA 101.
 - 7. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 - 8. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
 2. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.
 3. Installation of Wiring:
 - a. Conduit: Minimum conduit size is 3/4 inch.
 - b. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's published instructions.
 - c. Size conductors in accordance with lighting control device manufacturer's published instructions unless otherwise indicated.
 - d. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.
- D. Interfaces with Other Work:
1. Identification: Provide labels for lighting control devices and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Label each enclosure with engraved metal or laminated-plastic nameplate.
 - c. Identify controlled circuits in lighting contactors.
 - d. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
 - e. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Administrant for Electrical Power Tests and Inspections:
1. Administer and perform tests and inspections.
- B. Administrant for Lighting Tests and Inspections:
1. Administer and perform tests and inspections.
- C. Tests and Inspections:
1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Nonconforming Work:
1. Lighting control devices will be considered defective if they do not pass tests and inspections.
 2. Remove and replace defective units and retest.
- E. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.5 ADJUSTING

- A. Occupancy Adjustments: Provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Some of the Work may be required during hours of darkness.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.6 CLOSEOUT ACTIVITIES

- A. Demonstration:
 - 1. Demonstrate to Owner's maintenance and clerical personnel how to operate the following systems and equipment:
 - a. Lighting control devices.
- B. Training:
 - 1. Train Owner's maintenance personnel on the following topics:
 - a. How to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Panelboards.
 - 2. Disconnecting and overcurrent protective devices.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other requirements applicable to the Work for electrical, communications, and electronic safety and security systems on Project, including wiring methods.
 - 2. Section 260529 "Hangers and Supports for Electrical Systems" specifies concrete bases and supports for panelboards installed by this Section.
 - 3. Section 260548 "Vibration and Seismic Controls for Electrical Systems" specifies seismic control devices, mounting devices, and anchoring devices installed by this Section.
 - 4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
 - 5. Section 260573 "Power System Studies" specifies short-circuit current studies, overcurrent protective device coordination studies, and arc-flash hazard analysis studies.
 - 6. Section 262813 "Fuses" specifies fuses and spare-fuse cabinets installed by this Section.
 - 7. Section 264313 "Surge Protective Devices for Low-Voltage Electrical Power Circuits" specifies Type 1 and Type 2 surge protective devices installed by this Section.

1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. VPR: Voltage protection rating.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. In addition to information identified in Section 013300 "Submittal Procedures," submit the following:
 - 1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
- B. Shop Drawings: For each panelboard and related equipment:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Key interlock scheme drawing and sequence of operations.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include Internet link for electronic access to downloadable PDF of coordination curves.

- C. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Panelboard Schedules: For installation in panelboards.
- B. Manufacturer's published instructions.
- C. Field Reports:
1. Manufacturer's field reports for field quality-control support.
 2. Field reports for voltage monitoring and adjusting.
 3. Field reports for infrared scanning.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.6 QUALIFICATIONS

- A. Low-Voltage Electrical Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
1. On-site electrical testing supervisors must have documented certification and experience with testing electrical equipment in accordance with NETA testing standards.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation in accordance with NEMA PB 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- B. Fabricate and test panelboards in accordance with IEEE 344 to withstand seismic forces applicable to the Project.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Comply with NEMA PB 1.
- E. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: UL 50E, Type 1.
 - b. Outdoor Locations: UL 50E, Type 3R.
 - 2. Height: 7 ft maximum.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims must cover live parts and may have no exposed hardware.
 - 4. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
- F. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating must run entire length of bus.
 - b. Bus must be fully rated for entire length.
 - 2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Terminations must allow use of 75 deg C rated conductors without derating.
 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 4. Main and Neutral Lugs: Mechanical type, with lug on neutral bar for each pole in panelboard.
 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with lug on bar for each pole in panelboard.
- H. Quality-Control Label: Panelboards or load centers must be labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 20 percent.
- I. Panelboard Short-Circuit Current Rating:
1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.
 - a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
 - b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

2.2 PANELBOARDS

- A. UL QEUY - Distribution Panelboard:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business
 - b. Eaton
 - c. Siemens Industry, Inc., Energy Management Division
 - d. Square D; Schneider Electric USA
 2. Source Limitations: Obtain products from single manufacturer.
 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Distribution Type Panelboards: UL CCN QEUY; including UL 67 and NEMA PB 1.
 4. Standard Features:
 - a. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1) For doors more than 36 inch high, provide two latches, keyed alike.
 - b. Mains: As indicated on the Drawings.
 - 1) Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.
 - c. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
 - e. Branch Overcurrent Protective Devices: Fused switches.
 - 5. Other Available Features Required by Project:
 - a. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
 - b. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - c. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- B. UL QEUY - Lighting and Appliance Branch-Circuit Panelboard:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business
 - b. Eaton
 - c. Siemens Industry, Inc., Energy Management Division
 - d. Square D; Schneider Electric USA
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Lighting and Appliance Branch-Circuit Type Panelboards: UL CCN QEUY; including UL 67 and NEMA PB 1.
 - 4. Standard Features:
 - a. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
 - 5. Other Available Features Required by Project:
 - a. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
 - b. Do not mount neutral bus in gutter.
 - c. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - d. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - e. Doors: Door-in-door construction with concealed hinges; secured with flush or multipoint latch with tumbler lock; keyed alike. Outer door must permit full access to panel interior. Inner door must permit access to breaker operating handles and labeling, but current carrying terminals and bus must remain concealed.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Business
 - 2. Eaton
 - 3. Siemens Industry, Inc., Energy Management Division
 - 4. Square D; Schneider Electric USA

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
 - 3. GFPE Circuit Breakers: Class B ground-fault protection (30 mA trip).
 - 4. Subfeed Circuit Breakers: Vertically mounted.
 - 5. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Shunt Trip: 120 V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - i. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 A must have interchangeable rating plugs or electronic adjustable trip units.
 - j. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - k. Multipole units enclosed in single housing with single handle.

2.4 MAINTENANCE MATERIAL ITEMS

- A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards and related equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
 - 1. Keys: Two spares for each type of panelboard cabinet lock.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards in accordance with NEMA PB 1.1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
 - 1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA PB 1.1.
 - 2. Consult Architect for resolution of conflicting requirements.
- C. Special Techniques:
 - 1. Equipment Mounting:
 - a. Install floor-mounted panelboards on cast-in-place concrete equipment base(s).
 - b. Attach panelboard to vertical finished or structural surface behind panelboard.
 - c. Mount surface-mounted panelboards to steel slotted supports 5/8 inch] in depth. Orient steel slotted supports vertically.
 - d. Provide seismic control devices.
 - 2. Provide mounting and anchoring devices.
 - 3. Mount top of trim 7.5 ft above finished floor unless otherwise indicated.
 - 4. Mount panelboard cabinet plumb and rigid without distortion of box.
 - 5. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
 - 6. Install overcurrent protective devices and controllers not already factory installed.
 - a. Set field-adjustable, circuit-breaker trip ranges.
 - b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.
 - 7. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
 - 8. Install filler plates in unused spaces.
 - 9. Stub four 1 inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in future. Stub four 1 inch empty conduits into raised floor space or below slab not on grade.
 - 10. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- D. Interfaces with Other Work:
 - 1. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components.
- B. Install warning signs.
- C. Panelboard Nameplates: Label each panelboard with nameplate.
- D. Device Nameplates: Label each branch circuit device in power panelboards with nameplate.
- E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.
- F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.
- G. Circuit Directory:
 - 1. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
 - 2. Create directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

3.4 FIELD QUALITY CONTROL

- A. Adminstrant for Low-Voltage Electrical Tests and Inspections:
 - 1. Administer and perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Nonconforming Work:
 - 1. Panelboards will be considered defective if they do not pass tests and inspections.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Remove and replace defective units and retest.

E. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

1. Include certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature in accordance with manufacturer's published instructions.

END OF SECTION 262416

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with arc-fault and ground-fault protective devices.
4. Locking receptacles.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
3. Section 260533.16 "Boxes and Covers for Electrical Systems" specifies covers and cover plates referenced by this Section.
4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
5. Section 260923 "Lighting Control Devices" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.
6. Section 270528 "Pathways for Communications Systems" specifies additional requirements for raceway materials, routing, locations, and identification of communications equipment and cabling.

1.2 DEFINITIONS

- A. AFCI: Arc-Fault Circuit Interrupter.
- B. Commercial/Industrial-Use Cord Reel: A cord reel subject to severe use in factories, commercial garages, construction sites, and similar locations requiring a harder service-type cord.
- C. GFCI: Ground-Fault Circuit Interrupter.
- D. UL 1472 Type I Dimmer: Dimmer in which air-gap switch is used to energize preset lighting levels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
 - b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
 - c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are not acceptable for submitted product.

- B. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.
- B. Field Reports:
 1. Manufacturer's field reports for field quality-control support.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.6 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures, conduct tests of complex equipment, analyze test and equipment data, plan a job, and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems; evaluate tests, test equipment, test results, and power system performance; recommend actions to maintain or improve system performance; and lead multi-team projects.
- C. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour; Legrand North America, LLC
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: UL CCN WMUZ and UL 20.
4. Standard Features:
 - a. Device Color: White.
 - b. Configuration:
 - 1) Extra-heavy-duty, 120-277 V, 20 A, poles as indicated on the Drawings.
5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Cover Plate: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish; from same manufacturer as wiring device.
 - c. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. Type I Dimmer Switch:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. GE Lighting; a Savant Company
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - d. Leviton Manufacturing Co., Inc.
 - e. Lutron Electronics Co., Inc
 - f. Pass & Seymour; Legrand North America, LLC
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: UL CCN EOYX and UL 1472.
4. Standard Features:
 - a. UL 1472 Type I dimmer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Device Color: White.
- c. Switch Style: Toggle.
- d. Dimming Control Style: Slide.
- 5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Cover Plate: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish; from same manufacturer as wiring device.
 - c. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.3 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

A. Duplex Straight-Blade Receptacle:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC
- 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
 - b. Surge Protective Devices: UL 1449, Type 3.
- 3. Standard Features:
 - a. Device Color: White.
 - b. Configuration:
 - 1) Heavy-duty, NEMA 5-20R.
- 4. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Cover Plate: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish; from same manufacturer as wiring device.
 - c. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. Tamper-Resistant Duplex Straight-Blade Receptacle:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC
- 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
 - b. Surge Protective Devices: UL 1449, Type 3.
- 3. Standard Features:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Device Color: White.
- b. Configuration:
 - 1) Heavy-duty, NEMA 5-20R.
- 4. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Cover Plate: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish; from same manufacturer as wiring device.
 - c. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.4 RECEPTACLES WITH ARC-FAULT AND GROUND-FAULT PROTECTIVE DEVICES

- A. General-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle with AFCI and GFCI Device:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Outlet Branch-Circuit Type GFCIs and AFCIs: UL CCN KCXX, UL 498, UL 943, UL 1699, and UL Subject 1699A.
 - 3. Standard Features:
 - a. Device Color: White.
 - b. Configuration: Heavy-duty, NEMA 5-20R.
 - 4. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Cover Plate: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish; from same manufacturer as wiring device.
 - c. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.
- B. General-Grade, Weather-Resistant, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour; Legrand North America, LLC
 - 2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Receptacle GFCIs: UL CCN KCXS, UL 498, and UL 943.
- 3. Standard Features:
 - a. Device Color: White.
 - b. Configuration: Heavy-duty, NEMA 5-20R.
- 4. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Cover Plate: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish; from same manufacturer as wiring device.
 - c. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.5 LOCKING RECEPTACLES

- A. UL RTRT - NEMA, 125 V, Locking Receptacle:
 - 1. Manufacturers: Subject to compliance with requirements, :
 - a. ABB, Electrification Business
 - b. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - d. Leviton Manufacturing Co., Inc.
 - e. Pass & Seymour; Legrand North America, LLC
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
 - 4. Standard Features:
 - a. Device Color: Black with yellow voltage indication on face.
 - b. Configuration: 2 pole, 3 wire, grounding, NEMA configuration as indicated on the Drawings.
- B. UL RTRT - NEMA, 250 V, Locking Receptacle:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour; Legrand North America, LLC
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
 - 4. Standard Features:
 - a. Device Color: Black with blue voltage indication on face.
 - b. Configuration:
 - 1) NEMA configuration as indicated on the Drawings.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receptacles:
 - 1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
 - 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Electrical Safety: NFPA 70E.
 - 3. Life Safety and Means of Egress Work: NFPA 101.
 - 4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 - 5. Wiring Devices: NECA NEIS 130.
 - 6. Mounting Heights: NECA NEIS 1.
 - 7. Consult Architect for resolution of conflicting requirements.
- C. Interfaces with Other Work:
 - 1. Identification:
 - a. Identify cover or cover plate for device with panelboard identification and circuit number.
 - b. Provide warning signs and arc-flash hazard warning labels for electrical equipment.

3.3 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
 - 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Electrical Safety: NFPA 70E.
 - 3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 - 4. Work in ITE Rooms: NFPA 75.
 - 5. Work in Confined Spaces: NFPA 350.
 - 6. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 - 7. Installing and Maintaining Wiring Devices: NECA NEIS 130.
 - 8. Mounting Heights: Unless otherwise indicated in the Contract Documents, comply with mounting heights recommended in NECA NEIS 1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

9. Receptacle Orientation: Unless otherwise indicated in the Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
10. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:

1. Identification: Provide labels for receptacles and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Label each enclosure with engraved metal or laminated-plastic nameplate.
 - 1) Identify cover or cover plate for device with panelboard identification and circuit number.
 - c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.
2. Do not install Type 3 SPD, including surge-protected relocatable taps and power strips, on branch circuit downstream of GFCI device.

3.4 INSTALLATION OF LOCKING RECEPTACLES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
4. Work in ITE Rooms: NFPA 75.
5. Work in Confined Spaces: NFPA 350.
6. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
7. Installing and Maintaining Wiring Devices: NECA NEIS 130.
8. Mounting Heights: Unless otherwise indicated in the Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
9. Receptacle Orientation: Unless otherwise indicated in the Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
10. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:

1. Identification: Provide labels for receptacles and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Label each enclosure with engraved metal or laminated-plastic nameplate.
 - 1) Identify cover or cover plate for device with panelboard identification and circuit number.
 - c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.

3.5 FIELD QUALITY CONTROL OF SWITCHES

A. Adminstrant for Electrical Power Tests and Inspections:

1. Administer and perform tests and inspections.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Tests and Inspections:
 - 1. Perform tests and inspections in accordance with manufacturers' published instructions.
- C. Nonconforming Work:
 - 1. Unit will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.6 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

- A. Adminstrant for Electrical Power Tests and Inspections:
 - 1. Administer and perform tests and inspections.
- B. Tests and Inspections:
 - 1. Insert and remove test plug to verify that device is securely mounted.
 - 2. Verify polarity of hot and neutral pins.
 - 3. Measure line voltage.
 - 4. Measure percent voltage drop.
 - 5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
 - 6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' published instructions.
- C. Nonconforming Work:
 - 1. Device will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.7 FIELD QUALITY CONTROL OF LOCKING RECEPTACLES

- A. Adminstrant for Low-Voltage Electrical Tests and Inspections:
 - 1. Administer and perform tests and inspections.
- B. Tests and Inspections:
 - 1. Insert and remove test plug to verify that device is securely mounted.
 - 2. Verify polarity of hot and neutral pins.
 - 3. Measure line voltage.
 - 4. Measure percent voltage drop.
 - 5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
 - 6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' published instructions.
- C. Nonconforming Work:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Device will be considered defective if it does not pass tests and inspections.
 2. Remove and replace defective units and retest.
- D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.8 PROTECTION

- A. Devices:
1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
 2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 262726

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nonrenewable cartridge fuses.
 - 2. Spare-fuse cabinets.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
 - 2. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
 - 3. Section 260573 "Power System Studies" specifies coordination studies, arc-flash hazard analysis, warning labels, and circuit-breaker trip ranges referenced by this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software and in PDF format.
 - 5. Coordination charts and tables and related data.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra stock material.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 NONRENEWABLE CARTRIDGE FUSES

- A. Class J Nonrenewable Cartridge Fuse:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bussmann, an Eaton business
 - b. Edison; a brand of Bussmann by Eaton
 - c. Littelfuse, Inc.
 - d. Mersen USA
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by a qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Cartridge Fuses, Nonrenewable: UL CCN JDDZ, including UL 248-1 and UL 248-8 (Class J).
 - 4. Standard Features:
 - a. NEMA FU 1, Class J, 200 kA(sym) interrupt rating, current limiting, sizes up to 600 A, 600 V(ac), 8 to 10 s minimum time-delay at 500 percent, with rejection feature.
- B. Class RK5 Nonrenewable Cartridge Fuse:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bussmann, an Eaton business
 - b. Edison; a brand of Bussmann by Eaton
 - c. Littelfuse, Inc.
 - d. Mersen USA
 - 2. Source Limitations: Obtain products from single manufacturer.
 - 3. Listing Criteria: Investigated, labeled, and marked by a qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Cartridge Fuses, Nonrenewable: UL CCN JDDZ, including UL 248-1 and UL 248-12 (Class R).

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Standard Features:
 - a. NEMA FU 1, Class RK5, 200 kA(sym) interrupt rating, current limiting, sizes up to 600 A, 600 V(ac), non-time-delay, with rejection feature.
 - 1) Select ferrule terminals or knife blade terminals to match equipment where fuse is installed.

2.3 MAINTENANCE MATERIAL ITEMS

- A. Extra Stock Material: Furnish to Owner extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Include the following:
 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FUSES

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
 1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
 2. Electrical Maintenance: NFPA 70B.
 3. Electrical Safety: NFPA 70E.
 4. Work in Confined Spaces: NFPA 350.
 5. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 6. Fuse Applications: NECA NEIS 420.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- D. Interfaces with Other Work:
 - 1. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with results of coordination study and arc-flash hazard analysis.

END OF SECTION 262813

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Enclosures.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 DEFINITIONS

- A. GFEP: Ground-fault circuit-interrupter for equipment protection.
- B. GFLS: Ground-fault circuit-interrupter for life safety.
- C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 2. Enclosure types and details for types other than UL 50E, Type 1.
 - 3. Current and voltage ratings.
 - 4. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain products from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Business
 - 2. Eaton
 - 3. Siemens Industry, Inc., Energy Management Division
 - 4. Square D; Schneider Electric USA
- B. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole.
 - 3. 240 V(ac).
 - 4. 200 A and smaller].
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
 - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24 V(ac).
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ABB, Electrification Business
 2. Eaton
 3. Siemens Industry, Inc., Energy Management Division
 4. Square D; Schneider Electric USA
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240 V(ac), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24 V(ac).
 4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: Enclosure must be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (UL 50E Type 1) or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (UL 50E Types 3R, 12).
- C. Conduit Entry: UL 50E Types 4, 4X, and 12 enclosures may not contain knockouts. UL 50E Types 7 and 9 enclosures must be provided with threaded conduit openings in both endwalls.
- D. Enclosures designated as UL 50E Type 4, 4X stainless steel, 12, or 12K must have dual cover interlock mechanism to prevent unintentional opening of enclosure cover when circuit breaker is ON and to prevent turning circuit breaker ON when enclosure cover is open.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

3.2 SELECTION OF ENCLOSURES

- A. Indoor, Dry and Clean Locations: UL 50E, Type 1.
- B. Outdoor Locations: UL 50E, Type 3R.

3.3 INSTALLATION

- A. Comply with manufacturer's published instructions.
- B. Special Techniques:
 - 1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
 - 2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
 - 3. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
 - 4. Install fuses in fusible devices.

3.4 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that unit is clean.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
- e. Verify that fuse sizes and types match the Specifications and Drawings.
- f. Verify that each fuse has adequate mechanical support and contact integrity.
- g. Inspect bolted electrical connections for high resistance using one of the following methods:
 - 1) Use low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on Drawings.
- i. Verify correct phase barrier installation.
- j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
- 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - e. Perform ground fault test in accordance with NETA ATS Section 7.14 "Ground Fault Protection Systems, Low-Voltage."
- B. Nonconforming Work:
 - 1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- C. Collect, assemble, and submit test and inspection reports.
 - 1. Test procedures used.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.7 PROTECTION

- A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 262816

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 263213.16 - GAS-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gas-engine-driven generator sets.
 - 2. Gas engine.
 - 3. Gas fuel system.
 - 4. Control and monitoring.
 - 5. Generator overcurrent and fault protection.
 - 6. Generator, exciter, and voltage regulator.
 - 7. Outdoor generator-set enclosure.
 - 8. Vibration isolation devices.
- B. Related Requirements:
 - 1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.2 DEFINITIONS

- A. EPS: Emergency power supply.
- B. EPSS: Emergency power supply system.
- C. LP: Liquefied petroleum.
- D. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Include thermal damage curve for generator.
 - 3. Include time-current characteristic curves for generator protective device.
 - 4. Include fuel consumption in cubic feet per hour (cubic meters per hour) at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
 - 5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
 - 6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95 deg F, 80 deg F, 70 deg F, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.
- B. Shop Drawings:
1. Include plans and elevations for engine generator and other components specified.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Identify fluid drain ports and clearance requirements for proper fluid drain.
 4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
 6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight, supplied enclosure, and each piece of equipment not integral to the engine generator, and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Source Quality-Control Reports: Including, but not limited to, the following:
1. Certified summary of prototype-unit test report.
 2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
 3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
 4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
 5. Report of sound generation.
 6. Report of exhaust emissions showing compliance with applicable regulations.
 7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- D. Field quality-control reports.
- E. Warranty: For special warranty.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For engine generators to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - b. Operating instructions laminated and mounted adjacent to generator location.
 - c. Training plan.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GAS-ENGINE-DRIVEN GENERATOR SETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Generac
- B. Source Limitations: Obtain packaged engine generators and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Engine generator housing, engine generator, batteries, battery racks, silencers, and sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst-case normal levels.
 3. Component Importance Factor: 1.5.
- B. B11 Compliance: Comply with B11.19.
- C. NFPA Compliance:
1. Comply with NFPA 37.
 2. Comply with NFPA 70.
 3. Comply with NFPA 110 requirements for Level 2 EPSS.
- D. UL Compliance: Comply with UL 2200.
- E. Engine Exhaust Emissions: Comply with EPA Tier 2 requirements and applicable state and local government requirements.
- F. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- G. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
1. Ambient Temperature: 41 to 104 deg F.
 2. Relative Humidity: Zero to 95 percent.
 3. Altitude: Sea level to 30 feet.

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

- A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and use.
- C. Power Rating: Standby.
- D. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.
- E. EPSS Class: Engine generator shall be classified as Class 96 according to NFPA 110.
- F. Power Factor: 0.8, lagging.
- G. Frequency: 60 Hz.
- H. Induction Method: Naturally aspirated.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- I. Governor: Adjustable isochronous, with speed sensing.
- J. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- K. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
 - 2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- L. Engine Generator Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 - 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - 5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
 - 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 - 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
 - 8. Start Time:
 - a. Comply with NFPA 110, Type 10 system requirements.

2.4 GAS ENGINE

- A. Fuel: Natural gas.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System: Engine or skid-mounted.
 - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499 and with NFPA 110 requirements for Level 1 equipment for heater capacity.
- E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- F. Muffler/Silencer:
1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - a. Minimum sound attenuation of 25 dB at 500 Hz.
 - b. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 78 dBA or less.
- G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- H. Starting System: 12-V electric, with negative ground.
1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least twice without recharging.
 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 GAS FUEL SYSTEM

- A. Natural Gas Piping: Comply with requirements in Section 226813 "Facility Natural Gas Piping."
- B. Gas Train: Comply with NFPA 37.
- C. Engine Fuel System:
 1. Vapor-Withdrawal System:
 - a. Carburetor.
 - b. Secondary Gas Regulators: One for each fuel type, with atmospheric vents piped to building exterior.
 - c. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
 2. Fuel Filters: One for each fuel type.
 3. Manual Fuel Shutoff Valves: One for each fuel type.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Flexible Fuel Connectors: Minimum one for each fuel connection.

2.6 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates generator-set shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.
- B. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.
- C. Comply with UL 508A.
- D. Configuration:
 1. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine generator battery.
- E. Control and Monitoring Panel:
 1. Digital controller with integrated LCD, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
 2. Instruments: Located on the control and monitoring panel and viewable during operation.
 - a. Engine lubricating-oil pressure gage.
 - b. Engine-coolant temperature gage.
 - c. DC voltmeter (alternator battery charging).
 - d. Running-time meter.
 - e. AC voltmeter, for each phase.
 - f. AC ammeter, for each phase.
 - g. AC frequency meter.
 - h. Generator-voltage adjusting rheostat.
 3. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication, including the following:
 - a. Cranking control equipment.
 - b. Run-Off-Auto switch.
 - c. Control switch not in automatic position alarm.
 - d. Overcrank alarm.
 - e. Overcrank shutdown device.
 - f. Low water temperature alarm.
 - g. High engine temperature.
 - h. High engine temperature shutdown device.
 - i. Overspeed alarm.
 - j. Overspeed shutdown device.
 - k. Coolant low-level alarm.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- l. Coolant high-temperature alarm.
 - m. Coolant low-temperature alarm.
 - n. EPS supplying load indicator.
 - o. Battery high-voltage alarm.
 - p. Low cranking voltage alarm.
 - q. Battery-charger malfunction alarm.
 - r. Battery low-voltage alarm.
 - s. Lamp test.
 - t. Contacts for local and remote common alarm.
 - u. Remote manual stop shutdown device.
 - v. Air shutdown damper alarm when used.
 - w. Air shutdown damper shutdown device when used.
 - x. Hours of operation.
 - y. Engine generator metering, including voltage, current, Hz, kW, kVA, and power factor.
- F. Connection to Datalink:
 - 1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.
 - 2. Provide connections for datalink transmission of indications to remote data terminals via ModBus.
- G. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
 - 1. Overcrank alarm.
 - 2. Coolant low-temperature alarm.
 - 3. High engine temperature prealarm.
 - 4. High engine temperature alarm.
 - 5. Low lube oil pressure alarm.
 - 6. Overspeed alarm.
 - 7. Low fuel main tank alarm.
 - 8. Low coolant level alarm.
 - 9. Low cranking voltage alarm.
 - 10. Contacts for local and remote common alarm.
 - 11. Audible-alarm silencing switch.
 - 12. Air shutdown damper when used.
 - 13. Run-Off-Auto switch.
 - 14. Control switch not in automatic position alarm.
 - 15. Lamp test.
 - 16. Low cranking voltage alarm.
 - 17. Generator overcurrent protective device not closed.
- H. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- I. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.
 1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
 2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.
- B. Generator Overcurrent Protective Device:
 1. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:
 - a. Tripping Characteristic: Designed specifically for generator protection.
 - b. Trip Rating: Matched to generator output rating.
 - c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
 - d. Mounting: Adjacent to or integrated with control and monitoring panel.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide **six** lead alternator.
- E. Range: Provide broad range of output voltage by adjusting the excitation level.
- F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- G. Enclosure: Dripproof.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
 1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
 2. Maintain voltage within 30 percent on one step, full load.
 3. Provide anti-hunt provision to stabilize voltage.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

4. Maintain frequency within 15 percent and stabilize at rated frequency within 5 seconds.

- I. Subtransient Reactance: 12 percent, maximum.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description:
 1. Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 150 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
 - a. Sound Attenuation Level: Critical.
 2. Prefabricated or pre-engineered galvanized-steel-clad, integral structural-steel-framed enclosure, erected on concrete foundation.
- B. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 150 mph.
- C. Seismic Design: Comply with seismic requirements applicable to the Project.
- D. Hinged Doors: With padlocking provisions.
- E. Thermal Insulation: Manufacturer's standard materials and thickness to maintain winter interior temperature within operating limits required by engine generator components.
- F. Muffler Location: Within enclosure.
- G. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
 1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2.10 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 1. Material: Bridge-bearing neoprene, complying with AASHTO M 251 separated by steel shims.
 2. Minimum Deflection: 1 inch.
- B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
- 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
- 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
- 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- 6. Minimum Deflection: 1 inch.
- C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. Test generator, exciter, and voltage regulator as a unit.
 - 3. Full load run.
 - 4. Maximum power.
 - 5. Voltage regulation.
 - 6. Transient and steady-state governing.
 - 7. Single-step load pickup.
 - 8. Safety shutdown.
 - 9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 404.
- B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.
- C. Equipment Mounting:
 - 1. Install packaged engine generators on cast-in-place concrete equipment bases.
 - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
 - 3. Install engine generator in an enclosure] with restrained spring isolators having a minimum deflection of 1 inch on 4-inch- high concrete base. Secure enclosure to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- E. Gaseous Fuel Piping:
 - 1. Natural gas piping, valves, and specialties for gas distribution are specified in Section 226813 "Facility Natural Gas Piping."
- F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Gaseous Fuel Connections:
 - 1. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - 2. Install manual shutoff valve in a remote location to isolate gaseous fuel supply to the generator.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- E. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.4 IDENTIFICATION

- A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."
- B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency:
 - 1. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs below as specified in the NETA ATS. Certify compliance with test parameters.
 - a. Visual and Mechanical Inspection:
 - 1) Compare equipment nameplate data with drawings and specifications.
 - 2) Inspect physical and mechanical condition.
 - 3) Inspect anchorage, alignment, and grounding.
 - 4) Verify the unit is clean.
 - b. Electrical and Mechanical Tests:
 - 1) Perform insulation-resistance tests in accordance with IEEE 43.
 - a) Machines larger than 200 hp. Test duration shall be 10 minutes. Calculate polarization index.
 - b) Machines 200 hp or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.
 - 2) Test protective relay devices.
 - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
 - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
 - 5) Verify correct functioning of the governor and regulator.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - 6. Exhaust Emissions Test: Comply with applicable government test criteria.
 - 7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 - 8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.
- 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213.16

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Molded-case-type automatic transfer switches.
 - 2. Transfer switch accessories.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Molded-case-type automatic transfer switches.
 - 2. Transfer switch accessories.
- B. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
 - 2. Include material lists for each switch specified.
 - 3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
 - 4. Riser Diagram: Show interconnection wiring between transfer switches, annunciators, and control panels.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Seismic Qualification Data: Certificates, for transfer switches, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
 - 1. Include the following:
 - a. Features and operating sequences, both automatic and manual.
 - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Member company of NETA.
 - a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. Comply with NEMA ICS 1.
- C. Comply with NFPA 110.
- D. Comply with UL 1008 unless requirements of these Specifications are stricter.
- E. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
 - 2. Short-time withstand capability for three cycles.
- F. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- G. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- H. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

- I. Service-Rated Transfer Switch:
 - 1. Comply with UL 869A and UL 489.
 - 2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
 - 3. In systems with a neutral, the bonding connection shall be on the neutral bus.
 - 4. Provide removable link for temporary separation of the service and load grounded conductors.
 - 5. Surge Protective Device: Service rated.
 - 6. Service Disconnecting Means: Externally operated, manual mechanically actuated.
- J. Neutral Terminal: Solid and fully rated unless otherwise indicated.
- K. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed shrinkable sleeve markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
 - 4. Accessible via front access.
- N. Enclosures: General-purpose NEMA 250, Type 4X, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 MOLDED-CASE-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ABB, Electrification Business
 - 2. Eaton
 - 3. Emerson Electric Co., Automation Solutions
 - 4. Generac
 - 5. Lake Shore Electric Corporation
- B. Comply with Level 1 equipment according to NFPA 110.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using contactor-based components are unacceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching.
 - 4. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 5. Material: Hard-drawn copper, 98 percent conductivity.
 - 6. Main and Neutral Lugs: Mechanical type.
 - 7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 8. Ground bar.
 - 9. Connectors shall be marked for conductor size and type according to UL 1008.
- D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
- E. Transfer Switches Based on Molded-Case-Switch Components: Comply with UL 489 and UL 869A.
- F. Automatic Transfer-Switch Controller Features:
 - 1. Controller operates through a period of loss of control power.
 - 2. Undervoltage Sensing for Each Phase of NormalSource: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: Simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
 - 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
 - 11. Engine Shutdown Contacts:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is unavailable.

2.3 SOURCE QUALITY CONTROL

- A. Prepare test and inspection reports.
 1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
 - a. Overvoltage.
 - b. Undervoltage.
 - c. Loss of supply voltage.
 - d. Reduction of supply voltage.
 - e. Alternative supply voltage or frequency is at minimum acceptable values.
 - f. Temperature rise.
 - g. Dielectric voltage-withstand; before and after short-circuit test.
 - h. Overload.
 - i. Contact opening.
 - j. Endurance.
 - k. Short circuit.
 - l. Short-time current capability.
 - m. Receptacle withstand capability.
 - n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
 1. Install transfer switches on cast-in-place concrete equipment base(s).
 2. Comply with requirements for seismic control devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
 3. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
 4. Provide workspace and clearances required by NFPA 70.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- B. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.
- C. Identify components according to Section 260553 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- E. Comply with NECA 1.

3.2 CONNECTIONS

- A. Wiring Method: Install cables in raceways except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
 - 1. Comply with requirements for raceways specified in Section 260533.13 "Conduits for Electrical Systems."
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- E. Connect twisted pair cable according to Section 260523 "Control-Voltage Electrical Power Cables."
- F. Route and brace conductors according to manufacturer's written instructions and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- G. Brace and support equipment according to Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- H. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.3 FIELD QUALITY CONTROL

- A. Adminstrant for Tests and Inspections:
 - 1. Engage qualified testing agency to administer and perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing equipment, test for compliance with requirements according to NETA ATS.
 - 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with Drawings and Specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and required clearances.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Verify that the unit is clean.
 - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - f. Verify that manual transfer warnings are attached and visible.
 - g. Verify tightness of all control connections.
 - h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
 - i. Perform manual transfer operation.
 - j. Verify positive mechanical interlocking between normal and alternate sources.
 - k. Perform visual and mechanical inspection of surge arresters.
 - l. Inspect control power transformers.
 - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
 - 3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
3. Electrical Tests:
- a. Perform insulation-resistance tests on all control wiring with respect to ground.
 - b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
 - c. Verify settings and operation of control devices.
 - d. Calibrate and set all relays and timers.
 - e. Verify phase rotation, phasing, and synchronized operation.
 - f. Perform automatic transfer tests.
 - g. Verify correct operation and timing of the following functions:
 - 1) Normal source voltage-sensing and frequency-sensing relays.
 - 2) Engine start sequence.
 - 3) Time delay on transfer.
 - 4) Alternative source voltage-sensing and frequency-sensing relays.
 - 5) Automatic transfer operation.
 - 6) Interlocks and limit switch function.
 - 7) Time delay and retransfer on normal power restoration.
 - 8) Engine cool-down and shutdown feature.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
- a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Transfer switches will be considered defective if they do not pass tests and inspections.
- F. Remove and replace malfunctioning units and retest as specified above.
- G. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.
- C. Coordinate this training with that for generator equipment.

END OF SECTION 263600

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type 1 surge protective devices (SPDs).
2. Type 2 surge protective devices (SPDs).
3. Type 3, Type 4, and Type 5 surge protective devices (SPDs).
4. Enclosures.
5. Conductors and cables.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 262416 "Panelboards" for integral SPDs installed by panelboard manufacturer.
3. Section 262726 "Wiring Devices" for integral SPDs installed by receptacle manufacturer.

1.2 DEFINITIONS

- A. In: Nominal discharge current.
- B. Maximum Continuous Operating Voltage (MCOV): The maximum designated RMS value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.
- C. Metal-Oxide Varistor (MOV): An electronic component with a significant bidirectional, nonlinear current-voltage characteristic.
- D. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient overvoltages. Examples include: line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).
- E. SCCR: Short-circuit current rating.
- F. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.
- G. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- H. Type 3 SPDs: Point of utilization SPDs.
- I. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.
- J. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.
- K. Voltage Protection Rating (VPR): A rating selected from UL 1449 list of preferred values assigned to each mode of protection.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
 - a. Include electrical characteristics, specialties, and accessories for SPDs.
 - b. Certification of compliance with UL 1449 by qualified electrical testing laboratory recognized by authorities having jurisdiction including the following information:
 - 1) Tested values for VPRs.
 - 2) In ratings.
 - 3) MCOV, type designations.
 - 4) OCPD requirements.
 - 5) Manufacturer's model number.
 - 6) System voltage.
 - 7) Modes of protection.
- B. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

PART 2 - PRODUCTS

2.1 TYPE 1 SURGE PROTECTIVE DEVICES (SPDs)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Business
 - 2. DITEK Surge Protection
 - 3. Eaton
 - 4. Schneider Electric USA, Inc.
 - 5. Siemens Industry, Inc., Energy Management Division
- B. Source Limitations: Obtain devices from single source from single manufacturer.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

C. General Characteristics:

1. Reference Standards: UL 1449, Type 1.
2. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 240 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
4. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits must not exceed the following:
 - a. Line to Neutral: 700 V for 208Y/120 V.
 - b. Line to Line: 1200 V for 208Y/120 V.
5. SCCR: Not less than 100 kA.
6. In Rating: 20 kA.

D. Options:

1. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
2. Include indicator light display for protection status.
3. Include audible alarm.
4. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V(ac) for remote monitoring of protection status.
5. Include surge counter.

2.2 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business
2. Eaton
3. Schneider Electric USA, Inc.
4. Siemens Industry, Inc., Energy Management Division

B. Source Limitations: Obtain devices from single source from single manufacturer.

C. General Characteristics:

1. Reference Standards: UL 1449, Type 2.
2. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 100 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
4. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits must not exceed the following:
 - a. Line to Neutral: 700 V for 208Y/120 V.
 - b. Line to Ground: 700 V for 208Y/120 V.
 - c. Neutral to Ground: 700 V for 208Y/120 V.
 - d. Line to Line: 1200 V for 208Y/120 V.
5. SCCR: Equal or exceed 100 kA.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

6. In Rating: 20 kA.

D. Options:

1. Include LED indicator lights for power and protection status.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V(ac) for remote monitoring of protection status.
4. Include surge counter.

2.3 TYPE 3, TYPE 4, AND TYPE 5 SURGE PROTECTIVE DEVICES (SPDs)

A. Type 3, Type 4, and Type 5 SPDs are not approved for field installation.

2.4 ENCLOSURES

A. Indoor Enclosures: Type 1.

B. Outdoor Enclosures: Type 4X.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's instructions.
- B. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's instructions. Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
 2. Do not exceed manufacturer's recommended lead length.
 3. Do not bond neutral and ground.
- C. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
 2. Inspect anchorage, alignment, grounding, and clearances.
 3. Verify that electrical wiring installation complies with manufacturer's installation requirements.
- B. Nonconforming Work:
1. SPDs that do not pass tests and inspections will be considered defective.
 2. Remove and replace defective units and retest.
- C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

- A. Complete startup checks in accordance with manufacturer's instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION 264313

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Luminaires.
 - 2. Luminaire fittings.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
 - 2. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables" specifies wiring connections installed by this Section.
 - 3. Section 260529 "Hangers and Supports for Electrical Systems" specifies channel and angle supports installed by this Section.
 - 4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
 - 5. Section 260923 "Lighting Control Devices" specifies automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors installed by this Section.

1.2 DEFINITIONS

- A. BUG Rating: Backlight, uplight, and glare rating for light pollution from exterior luminaires.
- B. Correlated Color Temperature (CCT): The absolute temperature (in kelvins) of a blackbody whose chromaticity (color quality) most nearly resembles that of the light source.
- C. Color Rendering Index (CRI): The measure of the degree of color shift objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference light source. The lower the CRI of a light source, the more difficult it is to identify colors and stripes on electronic components and wiring.
- D. IDA: International Dark-Sky Association.
- E. IES: Illuminating Engineering Society.
- F. LPD: Lighting power density.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Luminaires: Include the following additional information:
 - a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - 1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
 - 2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
 - 3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.
 - 4) Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with current accreditation under National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 - b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - c. Include operating characteristics, electrical characteristics, and furnished accessories.
 - d. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on the Drawings.
 - e. Include battery and charger data for emergency lighting units.
 - f. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - g. Include photometric data and adjustment factors obtained from qualified laboratory tests.
 - h. Include manufacturer's sample warranty language.
2. Luminaire Fittings: Include the following additional information:
 - a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - 1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
 - 2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
 - 3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.
 - b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - c. Include operating characteristics, electrical characteristics, and furnished accessories.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- d. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on the Drawings.
- e. Include manufacturer's sample warranty language.

B. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturers' published instructions.
- B. Field Reports:
 - 1. Manufacturer's field reports for field quality-control support.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.6 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures; conduct tests of complex equipment; analyze test and equipment data; plan a job; and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems; evaluate tests, test equipment, test results, and power system performance; recommend actions to maintain or improve system performance; and lead multi-team projects.
- C. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 - 1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.
- D. Luminaire Photometric Testing Laboratory: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" accredited under NIST HB 150-1, and complying with applicable IES testing standards.
- E. Lighting Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing and inspecting lighting installations in accordance with applicable IES standards.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect exposed surface finishes on lighting equipment by applying strippable, temporary protective covering before shipping.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 LUMINAIRES

- A. Surface-Mounted Luminaire:
 - 1. Source Limitations: Obtain products for this luminaire type from single manufacturer
 - 2. Listing Criteria:
 - a. LED Luminaires: UL CCN IFAM; including UL 1598.
 - b. Outdoor Canopy Luminaires: UL CCN IFAW; including UL 1598.
 - c. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
 - 3. Standard Features:
 - a. Openings: Doors, frames, and access panels must operate smoothly, not leak light under operating conditions, and permit relamping without use of tools or parts falling from enclosure.
 - 1) Visible variations in metal finishes are unacceptable in adjoining components.
 - 4. Other Available Features Required by the Project:
 - a. Finishes:
 - 1) Reflecting surfaces must have minimum reflectance as follows, unless otherwise indicated:
 - a) White Surfaces: 85 percent.
 - b) Specular Surfaces: 83 percent.
 - c) Diffusing Specular Surfaces: 75 percent.
 - b. Visible variations in metal finishes are unacceptable in adjoining components.
 - c. Stainless steel latches.
 - d. Integral pressure equalizer.
 - 5. Installation Markings:
 - a. Relamping Labels: Include recommended lamp type, diameter, shape, size, wattage, and coating on factory-applied label that is visible when luminaire is open for relamping.
 - 6. Seismic and Wind Performance: Installed product must perform in accordance seismic requirements applicable to the Project and the following:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Withstand Requirement: Unit must remain in place without separation of parts when subjected to specified criteria during seismic events and unit must be fully operational after seismic events."
 - b. Component Importance Factor (Ip): 1.5.
- B. Recessed Luminaire:
 - 1. Source Limitations: Bin LEDs for this luminaire type within three-step MacAdam Ellipse to ensure consistent chromaticity for all luminaires of this type.
 - 2. Listing Criteria:
 - a. LED Luminaires: UL CCN IFAO; including UL 1598.
 - b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
 - 3. Standard Features:
 - a. Ceiling Compatibility: NEMA LE 4.
 - b. Openings: Doors, frames, and access panels must operate smoothly, not leak light under operating conditions, and permit relamping without use of tools or parts falling from enclosure.
 - 4. Installation Markings:
 - a. Relamping Labels: Include recommended lamp type, diameter, shape, size, wattage, and coating on factory-applied label that is visible when luminaire is open for relamping.
 - 5. Seismic and Wind Performance: Installed product must perform in accordance seismic requirements applicable to the Project and the following:
 - a. Withstand Requirement: Unit must remain in place without separation of parts when subjected to specified criteria during seismic events and unit must be fully operational after seismic events."
 - b. Component Importance Factor (Ip): 1.5.
- C. UL FTBR or FTBV - Emergency Lighting and Power Equipment:
 - 1. Source Limitations: Obtain products from single manufacturer.
 - 2. Listing Criteria:
 - a. Emergency Lighting and Power: UL CCN FTBR or UL CCN FTBV; including UL 924, NFPA 101, and ICC IBC.
 - b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
 - 3. Standard Features:
 - a. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - b. Status and Test Indication: Visible and accessible without opening luminaire or entering ceiling space.
 - 1) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 2) Test Push-Button: Push-to-test button in unit housing simulates loss of normal power and demonstrates unit operability.
 - c. Enclosure: UV stable thermoplastic housing rated for wet locations.
 - d. Flame Rating: UL 94 V-0.
 - 4. Other Available Features Required by the Project:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Internal-Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with driver.
 - 1) Emergency Connection: Operate continuously upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire driver.
 - 2) Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3) Nightlight Connection: Operate lamp continuously at 40 percent of rated light output.
 - 4) Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a) Push-Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 5) Battery Type: Ni-Cd.
 - 6) Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - 7) Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
 - 5. Installation Markings:
 - a. Relamping Labels: Include recommended lamp type, diameter, shape, size, wattage, and coating on factory-applied label that is visible when luminaire is open for relamping.
 - b. All luminaires (UL CCN HYXT):
 - 1) "SUITABLE FOR DAMP LOCATIONS."
 - 2) "SUITABLE FOR WET LOCATIONS."
 - 3) "SUITABLE FOR MOUNTING WITHIN 1.2 M (4 FT) OF THE GROUND" or "SUITABLE FOR FLOOR PROXIMITY INSTALLATION."
 - 6. Seismic and Wind Performance: Installed product must perform in accordance with seismic requirements applicable to the Project and the following:
 - a. Withstand Requirement: Unit must remain in place without separation of parts when subjected to specified criteria during seismic events and unit must be fully operational after seismic events."
 - b. Component Importance Factor (Ip): 1.5.
- D. UL FWBO - Exit Fixture:
- 1. Source Limitations: Obtain products from single manufacturer.
 - 2. Listing Criteria:
 - a. Exit Fixtures: UL CCN FWBO; including UL 924, NFPA 101, NFPA 5000, and ICC IBC.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
- 3. Standard Features:
 - a. Light Source: LED; 50,000 hours minimum rated life.
- 4. Seismic and Wind Performance: Installed product must perform in accordance with seismic requirements applicable to the Project and the following:
 - a. Withstand Requirement: Unit must remain in place without separation of parts when subjected to specified criteria during seismic events and unit must be fully operational after seismic events."
 - b. Component Importance Factor (Ip): 1.5.

2.3 LUMINAIRE FITTINGS

- A. Luminaire Support Accessories:
 - 1. Standard Features:
 - a. Sized and rated for luminaire weight.
 - b. Capable of maintaining luminaire position after cleaning and relamping.
 - c. Capable of supporting luminaire without causing deflection of ceiling or wall.
 - d. Capable of supporting horizontal force equal to 100 percent of luminaire weight and vertical force equal to 400 percent of luminaire weight.
 - 2. Other Available Features Required by the Project:
 - a. Hook Hangers: Integrated assembly matched to luminaire, supply voltage, and equipment with threaded attachment, cord, and locking-type plug.
 - b. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage wire supports 10 ft in length.
 - c. Aircraft Cables: 5/32 inch diameter aircraft cable supports 10 ft in length.
 - d. Single-Stem Hangers: 1/2 inch nominal diameter steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
 - e. Rod Hangers: 3/16 inch nominal diameter, cadmium-plated, threaded steel rod.

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 the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.2 PREPARATION

- A. Temporary Lighting: If approved by Architect, specified luminaires for the Project may be installed for temporary lighting. Install and energize minimum quantity of luminaires necessary to meet needs of construction activities. When construction is sufficiently complete, remove, disassemble, clean, and relamp luminaires used for temporary lighting before reinstalling for the Project's delivery.

3.3 INSTALLATION OF LIGHTING

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Electrical Construction: ICC IBC, ICC IFB, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 - 3. Work in Confined Spaces: NFPA 350.
 - 4. Installation of Indoor Lighting Systems: NECA NEIS 500.
 - 5. Installation of Exterior Lighting Systems: NECA NEIS 501.
 - 6. Installation of Luminaires, Lampholders, and Lamps: Article 410 of NFPA 70.
 - 7. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.
 - 8. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
 - 2. Install luminaires at height and aiming angle as indicated on the Drawings.
 - 3. Coordinate layout and installation of luminaires with other construction.
 - 4. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
 - 5. Exterior In-Ground Luminaires:
 - a. Install on concrete base with top 4 inch above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth.
 - 6. Exterior Corrosion Prevention:
 - a. Do not use aluminum in contact with earth or concrete. When in direct contact with dissimilar metals, protect aluminum with insulating fittings or treatment.
 - b. When embedding steel conduits in concrete, wrap conduit with 10 mil thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
 - 7. Flush-Mounted Luminaire Support:
 - a. Secured to outlet box.
 - b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - c. Trim ring flush with finished surface.
 - 8. Wall-Mounted Luminaire Support: Attached to structural members in walls.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- a. Do not attach luminaires directly to gypsum board.
 9. Suspended Luminaire Support:
 - a. Pendants and Rods: Where longer than 48 inch, brace to limit swinging.
 - b. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - c. Continuous Rows of Luminaires: Provide tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 - d. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
 10. Ceiling-Grid-Mounted Luminaire Support:
 - a. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inch from luminaire corners.
 - b. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for application.
 - c. Luminaires of Sizes Smaller than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with no fewer than two 3/4 inch metal channels spanning and secured to ceiling tees.
 - d. Seismic Restraint: Install at least one independent support rod or wire from structure to tab on luminaire. Wire or rod must have breaking strength for luminaire weight with safety factor of 3.0.
 11. Remote Mounting of Ballasts or Drivers: Do not exceed distance between ballast or driver and luminaire recommended by ballast or driver manufacturer.
 12. Emergency Power Units: Secure with approved fasteners in four or more locations, spaced near corners of unit.
 13. Install wiring connections for luminaires.
 14. Identification: Provide labels for luminaires and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Provide warning signs.
 - c. Label each enclosure with engraved metal or laminated-plastic nameplate.
- D. Systems Integration: Integrate lighting control devices and equipment with electrical power connections for operation of luminaires as specified.

3.4 FIELD QUALITY CONTROL OF LIGHTING

- A. Adminstrant for Electrical Power Tests and Inspections:
 1. Administer and perform tests and inspections.
- B. Adminstrant for Field Tests and Inspections of Lighting Installations:
 1. Administer and perform tests and inspections.
- C. Tests and Inspections:
 1. Perform manufacturer's recommended tests and inspections.
 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
 4. Verify operation of photoelectric controls.
- D. Nonconforming Work:
1. Luminaire will be considered defective if it does not pass tests and inspections.
 2. Remove and replace defective units and retest.
- E. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.5 CLOSEOUT ACTIVITIES

- A. Training:
1. Train Owner's maintenance personnel on the following topics:
 - a. How to adjust, operate, and maintain luminaires and photoelectric controls.
 2. Provide video recordings of training sessions to Owner.

3.6 PROTECTION

- A. After installation, protect lighting equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 265000

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cable supports and positioning devices.

B. Related Requirements:

1. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding conductors and connectors for communications pathways installed by this Section.
3. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers and supports for communications pathways installed by this Section.
4. Section 260533.13 "Conduits for Electrical Systems" specifies the following installed by this Section:
 - a. Type EMT-S duct raceways and elbows.
 - b. Type ERM-C-S duct raceways, elbows, couplings, and nipples.
 - c. Type LFMC duct raceways.
 - d. Type PVC duct raceways and fittings.
 - e. Fittings for conduit, tubing, and cable.
 - f. Electrically conductive corrosion-resistant compounds for threaded conduit.
 - g. Solvent cements.
5. Section 260533.16 "Boxes and Covers for Electrical Systems" specifies the following installed by this Section:
 - a. Metallic outlet boxes, device boxes, rings, and covers.
 - b. Junction boxes and pull boxes.
 - c. Cover plates for device boxes.
 - d. Hoods for outlet boxes.
6. Section 260543 "Underground Ducts and Raceways for Electrical Systems" specifies the following installed by this Section:
 - a. Duct accessories.
 - b. Handholes and boxes for exterior underground wiring.
 - c. Duct sealing.
7. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" specifies sleeves and sleeve seals for communications pathways installed by this Section.
8. Section 260553 "Identification for Electrical Systems" specifies labels and warning signs for communications pathways installed by this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. For each type of product.
 - a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - 1) If listed manufacturer differs from selling manufacture, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
 - 2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
 - 3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturers' published instructions submittals.

PART 2 - PRODUCTS

2.1 CABLE SUPPORTS AND POSITIONING DEVICES

- A. Description: This category covers straps, hooks, and similar types of hardware for installation and use in communications cabling systems in accordance with NFPA 70 and manufacturer's installation instructions
- B. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- C. UL DWMU - J-Hook or G-Hook Cable Support:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business
 - b. ADI
 - c. Cablofil; Legrand North America, LLC
 - d. Elite Components Inc.; subsidiary of SIGMA Piping Products (SPP) LLC
 - e. Panduit Corp
 - f. Southwire Company, LLC
 2. Source Limitations: Obtain products from single manufacturer.
 3. Product Listing Criteria: UL CCN DWMU; including UL 2239 or UL 1565.
 4. Product Characteristics:
 - a. Material: Galvanized steel.

PART 3 - EXECUTION

3.1 SELECTION OF PATHWAYS FOR COMMUNICATIONS SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.
- B. Minimum Pathway Size:
 - 1. For Copper and Aluminum Cables: Metric designator 25 (trade size 1).
 - 2. For Optical-Fiber Cables: Metric designator 25 (trade size 1).
- C. Maximum Pathway Length Between Cable Access Points: 75 ft.
- D. Temperature Limitations:
 - 1. Type PVC: Do not install where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
- E. Outdoor Pathways:
 - 1. Exposed and Subject to Severe Physical Damage: ERM C.
 - 2. Exposed and Subject to Physical Damage: ERM C.
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - 3. Exposed and Not Subject to Physical Damage: ERM C.
 - 4. Concealed Aboveground: ERM C.
 - 5. Direct Buried: PVC-40.
 - 6. Concrete Encased Not in Trench: PVC-40.
 - 7. Concrete Encased in Trench: PVC-40.
- F. Indoor Pathways:
 - 1. Hazardous Classified Locations: ERM C.
 - 2. Exposed and Subject to Severe Physical Damage: ERM C. Locations include the following:
 - a. Mechanical rooms.
 - 3. Exposed and Subject to Physical Damage: ERM C. Locations include the following:
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - b. Stub-ups to above suspended ceilings.
 - 4. Exposed and Not Subject to Physical Damage: EMT or Cable tray.
 - 5. Concealed above Suspended Ceilings: EMT or Hooks.
 - 6. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 7. Damp or Wet Locations: ERM C.
 - 8. Exposed to Environmental Air: EMT.
 - 9. In Vertical Runs: ERM C.
- G. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
 - 1. ERM C: Provide threaded-type fittings unless otherwise indicated.
- H. Cable Supports and Positioning Devices:

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

1. Size hooks to allow minimum of 25 percent future capacity without exceeding design capacity limits.
 2. Support hooks directly from building structure. Do not use ceiling grid support rods or wires.
 3. Hook spacing must allow no more than 6 inch of slack. Lowest point of cables must be no closer than 6 inch to ceiling tiles, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
 4. Space hooks no more than 5 ft on center.
 5. Provide hook at each change in direction.
- I. Boxes and Enclosures:
1. Outdoors, Aboveground: UL 50E Type 3R.
 2. Indoors: UL 50E Type 1, except use Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.
- J. Identification of Underground Pathways, Handholes, and Structures:
1. Use "COMMUNICATIONS" for legend on warning planks, underground warning tape, and covers.

3.2 SELECTION OF GROUNDING AND BONDING PRODUCTS

- A. Grounding and Bonding Conductors:
1. Communications Busbar Connections:
 - a. TBC: Not smaller than 1/0 AWG and no smaller than largest TBB.
 - b. TBB: Not smaller than 2 kcmil per linear ft of conductor length, but not larger than 750 kcmil, unless otherwise indicated on Drawings.
 - c. BBC: Not smaller than largest TBB to which it is connected unless otherwise indicated on Drawings.
 - d. TEBC: Not smaller than 2 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
 - e. UBC: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
 - f. Bonding Conductors to Structural Steel: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted clamp connectors.
 2. Underground Connections: Not smaller than 2 AWG. Provide welded connectors, except bolted connectors may be used in handholes or manholes and as otherwise indicated on Drawings.

3.3 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:
1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.
 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft above finished floor.
- B. Pipe and Conduit Labeling: Comply with ASME A13.1.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- C. Color Coding Scheme for Communications Cable and Terminations: Comply with BICSI N1 and TIA-598.
- D. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
 - 1. "COMMUNICATIONS."
 - 2. "FIRE ALARM."
 - 3. "SECURITY."
- E. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- F. Locations of Underground Lines: Underground-line warning tape for communication, control wiring, and optical-fiber cable.
- G. Communications Vaults, Handholes, and Pull and Junction Boxes: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with conductor designation.
- J. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
- K. Equipment Identification Labels:
 - 1. Black letters on white field.
 - 2. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 3. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 4. Equipment To Be Labeled:
 - a. Communications cabinets.
 - b. Access doors and panels for concealed communications items.
 - c. Emergency system boxes and enclosures.
 - d. Contactors.
 - e. Remote-controlled switches, dimmer modules, and control devices.
 - f. Monitoring and control equipment.
 - g. Security equipment.
 - h. Life-safety communications equipment.
- L. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Identify cover plate in accordance with TIA-606.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

- M. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.4 SELECTION OF SIGNS AND HAZARD MARKINGS

- A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.
- B. Signs, labels, and tags required for personnel safety must comply with the following standards:
 - 1. Safety Colors: NEMA Z535.1.
 - 2. Facility Safety Signs: NEMA Z535.2.
 - 3. Safety Symbols: NEMA Z535.3.
 - 4. Product Safety Signs and Labels: NEMA Z535.4.
 - 5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.
- C. Electrical Hazard Warnings:
 - 1. Multiple Power Sources Warning Legend: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT/RACK HAS MULTIPLE POWER SOURCES."
- D. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.

3.5 INSTALLATION OF PATHWAYS FOR COMMUNICATIONS SYSTEMS

- A. Comply with manufacturers' published instructions, including limitations on distance, bends, and bend radius.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Type OFR Optical-Fiber Raceways: Article 800 of NFPA 70 and BICSI N1.
 - 2. Type CR Communications Raceways: Article 800 of NFPA 70 and BICSI N1.
 - 3. Cable Supports and Positioning Devices: Article 800 of NFPA 70 and BICSI N1.
 - 4. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. Complete communications raceway installation before starting conductor installation.
 - 2. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
 - 3. Provide hangers and supports for pathways, boxes, and enclosures.
 - 4. Firestop pathway penetrations of fire-rated assemblies.
 - 5. Identification:
 - a. Provide safety warning signs.
 - b. Bury underground warning tape approximately 12 inch above direct-buried conduits, but minimum of 6 inch below grade. Align tape along centerline of conduit.

COLLETON COUNTY CORONOR'S OFFICE RENOVATIONS

3.6 PROTECTION

- A. Protect coatings and finishes of pathways, boxes, and enclosures from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

DOCUMENT 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
 - 2. Swing gates.
 - 3. Horizontal-slide, motor-operated gates.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories.
 - d. Gates and hardware.
 - e. Gate operators, including operating instructions and motor characteristics.
- B. Shop Drawings: For each type of fence and gate assembly.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include accessories, hardware, gate operation, and operational clearances.
 - 3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - 4. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal:
 - 1. For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. For mechanical design of motorized gates signed and sealed by the qualified professional engineer responsible for their preparation.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence, operator, and gate.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of gate operators and controls.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

1. Design chain-link fence and gate frameworks.
 2. Design motorized gates and operators.
- B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
1. Design Wind Load: 130 mph.
- C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
1. Fabric Height: As indicated on Drawings.
 2. Steel Wire for Fabric: Wire diameter of 0.192 inch.
 - a. Mesh Size: 2 inches.
 - b.
 - c. Polymer-Coated Fabric: ASTM F 668, Class 2a over Zn-5-Al-MM-alloy-coated steel wire.
 - 1) Color: Black, according to ASTM F 934.
 3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
1. Fence Height: As indicated on Drawings.
 2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 2.375 inches in diameter.
 - b. End, Corner, and Pull Posts: 2.875 inches in diameter.
 3. Horizontal Framework Members: Comply with ASTM F 1043.
 4. Brace Rails: Comply with ASTM F 1043.
 5. Metallic Coating for Steel Framework:
 - a. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) coating.
 6. Polymer coating over metallic coating.
 - a. Color: Black, according to ASTM F 934.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.4 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.177-inch-diameter, tension wire according to ASTM F 1664, Class 2a over Zn-5-Al-MM-alloy-coated steel wire.
 - 1. Color: Black, according to ASTM F 934.

2.5 SWING GATES

- A. General: ASTM F 900 for gate posts and single and double swing gate types.
 - 1. Gate Leaf Width: As indicated.
 - 2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
 - 2. Gate Posts: Round tubular steel.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Hardware:
 - 1. Hinges: 360-degree inward and outward swing.
 - 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.6 HORIZONTAL-SLIDE GATES

- A. General: ASTM F 1184 for gate posts and single sliding gate types. Provide automated vehicular gates according to ASTM F 2200.
 - 1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
 - a. Gate Frame Width and Height: As indicated.
- B. Pipe and Tubing:
 - 1. Gate Posts: ASTM F 1184. Provide round tubular steel posts.
 - 2. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Hardware:
 - 1. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.
 - 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.7 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Tension and Brace Bands: Pressed steel.
- E. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- F. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- G. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire.
- H. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
 - a. Polymer coating over metallic coating.

2.8 GATE OPERATORS

- A. Operators: Factory-assembled, automatic, gate-operating system designed for gate size, type, weight, and frequency of use. Control system shall have characteristics suitable for Project conditions, with control stations, safety devices, and weatherproof enclosures.
 - 1. Operator design shall allow for removal of cover or motor without disturbing limit-switch adjustment and without affecting auxiliary emergency operation.
 - 2. Electronic components shall have built-in troubleshooting diagnostic feature.
 - 3. Unit shall be designed and wired for both right-hand/left-hand opening, permitting universal installation.
- B. 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.
- C. UL Standard: Manufacture and label gate operators according to UL 325.
- D. Motors: Comply with NEMA MG 1.
 - 1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
 - 2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3. Service Factor: 1.15.
4. Electrical Characteristics:
 - a. Horsepower: Per delegated design.
 - b. Voltage: Per delegated design.
 - c. Voltage: Per delegated design.

E. Gate Operators: Gate, Equipment base/pad, Pedestal post, in ground mounted and as follows:

1. Mechanical Slide Gate Operators:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum 60 feet per minute.
 - c. Maximum Gate Weight: 800 lb.
 - d. Frequency of Use: Continuous duty.
 - e. Operating Type: Per delegated design.
 - f. Drive Type: Per delegated design.
 - g. Drive Type: Per delegated design.

F. Controls: Electric controls separated from gate and motor and drive mechanism, with enclosure to be determined by delegated design.

G. Control Devices:

1. Card Reader: To be determined by delegated design.

H. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.

I. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully open and fully closed positions.

J. Emergency Release Mechanism: Quick-disconnect release of operator drive system, permitting manual operation if operator fails. Control circuit power is disconnected during manual operation.

1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

2.9 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

2.10 GROUNDING MATERIALS

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. To be determined by delegated design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line.
- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil. Portions of fence may be located over concrete, in which case, placement of the post sleeves will need to be coordinated with the paving contractor.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Place top of concrete 2 inches below grade to allow covering with surface material.
- C. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- D. Line Posts: Space line posts uniformly at 96 inches o.c.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 - 1. As indicated on Drawings of delegated design.
- G. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- H. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- J. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GATE-OPERATOR INSTALLATION

- A. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate-operator component manufacturer's written instructions and as indicated.
- C. Ground electric-powered motors, controls, and other devices according to NFPA 70 and manufacturer's written instructions.

COLLETON COUNTY CORONER'S OFFICE RENOVATIONS

3.6 GROUNDING AND BONDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fence and Gate Grounding: Per delegated design.
- C. Comply with requirements in Section 264113 "Lightning Protection for Structures."

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests.
- B. Grounding Tests: Comply with requirements in Section 264113 "Lightning Protection for Structures."
- C. Prepare test reports.

3.8 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.
 - 1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
 - 2. Test and adjust operators, controls, and safety devices. Replace damaged and malfunctioning controls and equipment.
 - 3. Lubricate operator and related components.
- C. Lubricate hardware and other moving parts.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF DOCUMENT 323113