SECTION 23 0500

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Hangers and Supports for Plumbing Piping Equipment:
   1. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
      a. Design supports for multiple pipes capable of supporting combined weight of supported systems, and system contents.
      b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
      c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.02 SLEEVES AND SLEEVE SEALS

A. Galvanized-Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. PVC Pipe: ASTM D 1785, Schedule 40.

C. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

D. Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   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.

E. Stack-Seal Fitting: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.03 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2.04 ESCUTCHEONS AND FLOOR PLATES

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. One-Piece Floor Plates: Cast-iron flange.

2.05 PRESSURE GAGES AND TEST PLUGS

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Standard: ASME B40.100.
   2. Case: Sealed Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
   3. Movement: Mechanical, with link to pressure element and connection to pointer.
   4. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
   5. Pointer: Dark-colored metal.
   6. Window: Plastic.
   7. Ring: Metal.
   8. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating of 500 psig at 200 deg F (3450 kPa at 93 deg C).

2.06 HANGERS AND SUPPORTS FOR HVAC

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe 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.

C. Fastener Systems:
   1. Verify suitability of fasteners in this article for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
   2. 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.
   3. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

D. Miscellaneous Materials:

1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   a. Properties: Nonstaining, noncorrosive, and nongaseous.
   b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

3.01 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Sleeves:
   1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
   2. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
      a. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
   3. Install stack-sleeve fittings in new slabs as slabs are constructed.
   4. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
   5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8400 "Firestopping."

D. Sleeve-Seal-System Installation:
   1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
   2. 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.

E. Escutcheons & Floor Plates:
   1. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
   2. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   3. Install floor plates for piping penetrations of equipment-room floors.
   4. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

F. Install unions at final connection to each piece of equipment.

G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

H. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.02 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.

D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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 (DN 15 to DN 750).
   2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
   3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
   4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
   5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

3.03 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment in strict accordance with the manufacturer's installation instructions and clearance requirements.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with

minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment to allow right of way for piping installed at required slope.

F. Mix and install grout for pump and other equipment base plates, and anchors. Place grout, completely filling equipment bases.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

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

B. Efficiency
   1. Motor efficiencies shall be greater than or equal to the requirements of Chapter 13 of the Florida Building Code.

PART 2 PRODUCTS

2.01 MOTOR CHARACTERISTICS

A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.
   1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

C. Polyhase Motors:
   1. Description: NEMA MG 1, Design B, medium induction motor.
      a. Service Factor: 1.15.
   2. Multispeed Motors: Variable torque.
      a. For motors with 2:1 speed ratio, consequent pole, single winding.
      b. For motors with other than 2:1 speed ratio, separate winding for each speed.
   3. Rotor: Random-wound, squirrel cage.
   4. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
   5. Temperature Rise: Match insulation rating.
   6. Insulation: Class F.
   7. Code Letter Designation:
      a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
      b. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
   8. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Polyphase Motors with Additional Requirements
   1. 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.

2. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

E. Single Phase Motors:
   1. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
      a. Permanent-split capacitor.
      b. Split phase.
      c. Capacitor start, inductor run.
      d. Capacitor start, capacitor run.
   2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
   3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
   4. Motors 1/20 HP and Smaller: Shaded-pole type.
   5. 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 (NOT USED)

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each product indicated.
   2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   3. Welding certificates.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:
   1. Basic Wind Speed: 140 mph.
   2. Building Classification Category: II.
   3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2.02 VIBRATION ISOLATORS

A. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
   1. Resilient Material: Oil- and water-resistant neoprene.

B. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

PART 3 EXECUTION

3.01 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:
   1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

B. Piping Restraints:
   1. Comply with requirements in MSS SP-127.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

E. 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.

F. Drilled-in 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 the 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 Anchors: 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
   5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.02 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.03 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.04 SCHEDULE

A. For equipment mounted on the roof:
   1. Neoprene pad isolators, minimum of one at each corner.

B. For equipment mounted on the floor:
   1. Neoprene pad isolator, minimum one in each corner.

C. Refrigerant piping:
   1. Elastomeric hangers, minimum of first three supports at equipment.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Certified TAB reports.
   2. Documentation of work performed per ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   3. Documentation of work performed per ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

B. TAB Firm Qualifications: AABC certified.

C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.

D. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 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 the approved submittals for HVAC systems and equipment.

C. Examine systems for installed balancing devices, such as test ports, gage cocks,, and manual volume dampers. Verify that locations of these balancing devices are accessible.

D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices are operated by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Integrity of dampers and valves for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
   4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   5. Sensors are located to sense only the intended conditions.
   6. Sequence of operation for control modes is according to the Contract Documents.
   7. Controller set points are set at indicated values.

8. Interlocked systems are operating.
9. Changeover from heating to cooling mode occurs according to indicated values.

G. Report deficiencies discovered before and during performance of test and balance procedures.

3.02 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, 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.

3.03 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare schematic diagrams of systems' "as-built" duct layouts.

B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

C. Verify that motor starters are equipped with properly sized thermal protection.

D. Check for airflow blockages.

E. Check condensate drains for proper connections and functioning.

F. Check for proper sealing of air-handling unit components.

G. Check for proper sealing of air duct system.

3.04 DIRECT EXPANSION AIR CONDITIONING EQUIPMENT

A. Simulate full load conditions

B. Take all measurements at maximum design air flow:
1. Outside air temperature
2. Return air temperature
3. Mixed air temperature
4. Supply air temperature
5. Actual supply air flow

C. Simulate heating and cooling

D. Record electrical data:
1. Unit running load amps
2. Voltage
3. Electric heat amp draw

4. Name plate branch circuit protection requirements
5. Actual branch circuit protection provided

3.05 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
   2. Air Outlets and Inlets: Plus or minus 5 percent.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 0700
HVAC INSULATION

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of product indicated.
   2. For adhesives and sealants, documentation including printed statement of VOC content.

B. Quality Assurance: Labeled with maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to ASTM E 84.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics:
   1. Indoor Insulation and related materials: To be factory labeled designating maximum flame-spread index of 25 or less, and smoke-developed index of 50 or less according to ASTM E 84.
   2. Outdoor Insulation and related materials: To be factory labeled designating maximum flame-spread index of 75 or less, and smoke-developed index of 150 or less according to ASTM E 84.

2.02 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

C. Mineral-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, Type I.

D. Mineral-Fiber Board Insulation: Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation without factory-applied jacket.

E. Mineral-Fiber, Preformed Pipe Insulation: Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.

F. Mineral-Fiber, Pipe and Tank Insulation: Complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB; and having factory-applied ASJ. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less.

G. Polyolefin Insulation: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

H. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services; comply with MIL-PRF-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

K. Factory-Applied Jackets: 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

L. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

M. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3 EXECUTION

3.01 INSULATION INSTALLATION

A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Section 078413 "Penetration Firestopping."

D. Flexible Elastomeric Insulation Installation:
   1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
   2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Mineral-Fiber Insulation Installation:
   1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
4. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
5. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier.

F. Polyolefin Insulation Installation:
1. Seal split-tube longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of polyolefin pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

G. Plenums and Ducts Requiring Insulation:
1. Concealed and exposed supply and outdoor air.
2. Concealed and exposed return air located in nonconditioned space.
3. Concealed and exposed exhaust between isolation damper and penetration of building exterior.

H. Plenums and Ducts Not Insulated:
1. Factory-insulated plenums and casings.
2. Flexible connectors.
3. Vibration-control devices.
4. Factory-insulated access panels and doors.

I. Piping Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawlspaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.02 DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density with a minimum installed 'R' value of 6.0.
2. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density with a minimum installed 'R' value of 6.0.

B. Exposed duct insulation shall be one of the following:
1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density with a minimum installed 'R' value of 6.0.

3.03 HVAC PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:
   1. Flexible Elastomeric: 1 inch (25 mm) thick.

C. Condensate Drain Piping: Insulation shall be as follows:
   1. Flexible Elastomeric: 1 inch (25 mm) thick.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
   2. Piping Design: The contractor shall submit refrigerant pipe sizing calculations for each air conditioning system. The calculation shall be certified by the manufacturer and shall include a schematic drawing indicating all changes in direction and elevation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIRMENTS

A. Comply with ASME B31.5, "Refrigerant Piping," and with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

2.02 TUBES AND FITTINGS

A. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B) and ASTM B 280, Type ACR.

B. Wrought-Copper Fittings and Unions: ASME B16.22.

C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

D. Brazing Filler Metals: AWS A5.8.

2.03 VALVES AND SPECIALTIES

A. Thermostatic Expansion Valve: Comply with ARI 750; forged brass or steel body, stainless-steel internal parts, copper tubing filled with refrigerant charge for 40 deg F (5 deg C) suction temperature; 700-psig (4820-kPa) working pressure, and 240 deg F (116 deg C) operating temperature.

B. Solenoid Valves: Comply with ARI 760; 240 deg F (116 deg C) temperature rating, 400-psig (2760-kPa) working pressure, 240 deg F (116 deg C) operating temperature; and 24-V normally closed holding coil.

C. Strainers: Welded steel with corrosion-resistant coating and 100-mesh stainless-steel screen with socket ends; 500-psig (3450-kPa) working pressure and 275 deg F (135 deg C) working temperature.

D. Moisture/Liquid Indicators: 500-psig (3450-kPa) operating pressure, 240 deg F (116 deg C) operating temperature; with replaceable, polished, optical viewing window and color-coded moisture indicator.

E. Filter Dryers: 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature; withgaskets, and filter-dryer cartridge.

F. Mufflers: Welded steel with corrosion-resistant coating and socket ends; 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature.

G. Refrigerant: ASHRAE 34, R-410A.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with requirements in Section 230500 "Common Work Results for HVAC" for basic piping installation requirements.

B. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Section 230500 "Common Work Results for HVAC" for wall penetration systems.

C. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

D. Insulate suction lines to comply with Section 230700 "HVAC Insulation."

E. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.

F. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.

H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

I. Install strainers upstream from and adjacent to solenoid valves, thermostatic expansion valves, and compressors unless they are furnished as an integral assembly for device being protected:

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

3.02 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of product indicated.
   2. Documentation indicating that duct systems and accessories comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   3. Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning." and Section 6.4.4 - "HVAC System Construction and Insulation."
   4. Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
   5. For adhesives and sealants, documentation including printed statement of VOC content.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

G. Comply with UL 181 for ducts and closures.

2.02 DUCTS

A. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip galvanized coating.
   1. Galvanized Coating Designation: G90 (Z275).
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

B. Fibrous-Glass Duct Board: Comply with UL 181, Class 1, 1-inch- (25-mm-) thick, fibrous glass with fire-resistant, reinforced foil-scrim-kraft barrier, and having the air-side surface treated to prevent erosion.

C. Joint and Seam Tape, and Sealant: Comply with UL 181A.

D. Rectangular Metal Duct Fabrication: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Fibrous-Glass Duct Fabrication: Comply with SMACNA's "Fibrous Glass Duct Construction Standard."

2.03 ACCESSORIES

A. Volume Dampers and Control Dampers: Single-blade and multiple opposed-blade dampers, standard leakage rating, and suitable for horizontal or vertical applications; factory fabricated and complete with required hardware and accessories. Provide edge seals.

B. Fire Dampers: Rated and labeled according to UL 555 by an NRTL; factory fabricated and complete with required hardware and accessories. Type B with blades outside of air stream.

C. Ceiling Fire Dampers: Labeled according to UL 555C by an NRTL and complying with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory." Provide factory-fabricated units complete with required hardware and accessories.

D. Smoke Dampers: Labeled according to UL 555S by an NRTL. Combination fire and smoke dampers shall also be rated and labeled according to UL 555. Provide factory-fabricated units complete with required hardware and accessories.

E. Flexible Connectors: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

F. Flexible Ducts: Factory-fabricated, insulated, round duct, with an outer jacket enclosing glass-fiber insulation around a continuous inner liner complying with UL 181, Class 1. Installed "r" values shall be a minimum of 6.0.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Outdoor, Supply-Air Ducts: Seal Class A.
   2. Outdoor, Exhaust Ducts: Seal Class C.
   3. Outdoor, Return-Air Ducts: Seal Class C.
   4. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa)and Lower: Seal Class B.
   5. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
   6. Unconditioned Space, Exhaust Ducts: Seal Class C.
   7. Unconditioned Space, Return-Air Ducts: Seal Class B.
   8. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa)and Lower: Seal Class C.

9. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
10. Conditioned Space, Exhaust Ducts: Seal Class B.
11. Conditioned Space, Return-Air Ducts: Seal Class C.

C. Conceal ducts from view in finished and occupied spaces.

D. Avoid passing through electrical equipment spaces and enclosures.

E. Support ducts to comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Hangers and Supports."

F. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

G. Install volume and control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.

H. Install fire and smoke dampers according to UL listing.

I. Install fusible links in fire dampers.

J. Clean duct system(s) before testing, adjusting, and balancing.

K. Paint manual volume damper handles neon orange.

3.02 TESTING, ADJUSTING, AND BALANCING

A. Balance airflow within distribution systems, including submains, branches, and terminals to indicated quantities.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Products shall be licensed to use the AMCA-Certified Ratings Seal.

B. Power ventilators shall comply with UL 705.

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.

2.02 CENTRIFUGAL VENTILATORS

A. Manufacturers: One of the following:
   1. Acme Engineering & Manufacturing Corporation.
   2. Carnes Company.
   3. Greenheck Fan Corporation.
   4. Loren Cook Company.
   5. PennBarry.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
   1. Upblast Units: Aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
   2. Wall-Mounting Units: Aluminum rectangular base with venturi inlet cone, motor mount, and vibration isolators designed for wall mounting.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing.
   1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
   4. Fan and motor isolated from exhaust airstream.

E. Accessories:
   1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
   2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
   3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
   1. Configuration: Built-in raised cant and mounting flange.
   2. Overall Height: 12 inches (300 mm).
   3. Pitch Mounting: Manufacture curb for roof slope.
   4. Mounting Pedestal: Galvanized steel with removable access panel.
   5. Florida product approval and Miami Dade Notice of Acceptance for 150 mph wind.

2.03 CEILING-MOUNTED VENTILATORS

A. Manufacturers: One of the following:
   1. Carnes Company.
   2. Greenheck Fan Corporation.
   3. Loren Cook Company.
   4. PennBarry.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered or egg-crate grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
   3. Isolation: Rubber-in-shear vibration isolators.
   4. Provide optional roof curb and roof cap accessory

2.04 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC 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.

B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units with clearances for service and maintenance.

B. Roof-Mounted Units: Install roof curb on roof structure, according to ARI Guideline B. Install and secure roof-mounted fans on curbs, and coordinate roof penetrations and flashing with roof construction.

C. Ceiling-Mounted Units: Suspend units from structure using steel wire or metal straps.

D. Ground power ventilators.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 3713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of product indicated, including color charts for factory finishes.

PART 2 PRODUCTS

2.01 OUTLETS AND INLETS

A. Diffusers:
   1. Manufacturers: One of the following:
      a. METALAIRE, Inc.
      b. Price Industries.
      c. Titus.
      d. Tuttle & Bailey.
   2. Material: Aluminum.
   3. Finish: Baked enamel, white.
   4. Mounting: Surface and T-bar.

B. Wall, Ceiling Registers and Grilles:
   1. Manufacturers: One of the following:
      a. METALAIRE, Inc.
      b. Price Industries.
      c. Titus.
      d. Tuttle & Bailey.
   2. Material: Aluminum.
   3. Finish: Baked enamel, white.
   4. Mounting: Countersunk screw.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel unless otherwise indicated. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 5400
FURNACES

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of product indicated.
   2. Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   3. For solvent cements and adhesive primers, documentation including printed statement of VOC content.

B. Warranties: Submit a written warranty executed by manufacturer agreeing to repair or replace furnaces that fail in materials or workmanship within 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. 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 application.

B. ASHRAE Compliance:
   1. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup.
   2. Minimum Efficiency: Comply with ASHRAE/IESNA 90.1.

2.02 ELECTRIC FURNACES

A. Comply with NFPA 70.
   1. Fan Motor: Multispeed.
   2. Heater Control: Sequencer relay with relay for each element.
   3. Single-Point Electrical Connection

B. Electric-Resistance Heating:
   1. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
   2. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
   3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
   4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
      a. Magnetic contactors.
      b. Step Controller: Pilot lights and override toggle switch for each step.

c. Airflow proving switch.

2.03 ACCESSORIES

A. Controls: Include components required for operation of furnaces and auxiliary equipment in all seasons.

B. Filters: 1-inch- (25-mm-) thick, disposable, fiberglass type in sheet metal rack.

2.04 REFRIGERATION COMPONENTS

A. Evaporator Coil: Comply with ARI 210/240. Match size with furnace. Match remote condensing unit specified in Section 236200 "Packaged Compressor and Condenser Units" with type, capacity, pressure-drop ratings, restricted distributor, or expansion valve. Include condensate drain pan with drain outlet.

B. Evaporator Coil Enclosure: As required to suit furnace and cooling coil. Steel cabinet with access panel and flanges for integral mounting at or on furnace cabinet.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; with insulated suction line and appropriate fittings at ends.

2.05 CONTROLS

A. Thermostat: 24-V ac, solid-state, programmable, microprocessor-based, wall-mounted unit with automatic switching from heating to cooling, minimum four temperature presets selectable by day and time, and battery backup protection of program settings against power failure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Outside-Air Pipe Connections, and Drains:
   1. Install vent terminal designed to protect against birds, insects, and dirt.
   2. Install condensate overflow switch to disable unit and indicate trouble on thermostat.

B. Connect condensate drains to indirect waste using copper tubing with streamline drainage fittings and soldered joints. Extend to nearest equipment drain or floor drain. Construct vented, deep trap at connection to drain pan and install cleanouts at changes in direction. Terminate to suit local code requirements.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base where installation conditions require.

D. Controls: Install thermostats and humidistats adjacent to light switches at approximately 60 inches (1500 mm) above finished floor.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 6200

PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: For each type of product indicated.
   2. Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1.

B. Warranties: Submit a written warranty, signed by manufacturer, agreeing to repair or replace components that fail within five years after Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Verify performance according to ARI 210/240.

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. Comply with ASHRAE 15.

D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.02 AIR-COOLED CONDENSING UNITS 1 TO 5 TONS (3.5 TO 17.6 kW)

A. Description: Factory assembled and tested, air cooled; consisting of compressors, condenser coils, fans, motors, refrigerant reservoirs, and operating controls.
   1. Manufacturers: One of the following:
      a. Carrier Corporation; Commercial HVAC Systems.
      b. Lennox International Inc.
      c. Rheem Air Conditioning Division.
      d. Ruud Air Conditioning Division.
      e. Trane; a business of American Standard Companies.
      f. YORK; a Johnson Controls company.
   2. Compressor: Hermetically sealed and isolated for vibration. Include thermal-, current-, and temperature-sensitive overload devices, start capacitor, relay, and contactor.
   3. Refrigerant Charge: R-410A.
   4. Condenser Coil: Copper-tube, aluminum-fin coil, with liquid subcooler.
   5. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated motor with thermal-overload protection.
   6. Accessories: Include the following:
      a. Valves for service and charging.
      b. High- and low-pressure safety switches.
      c. Low-ambient kit to permit operation down to 45 deg F (7 deg C).
      d. Crankcase heater.

e. Automatic reset timer to prevent compressor rapid cycle.
f. Reversing valve.
g. Defrost control sequence.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units level and plumb. Maintain recommended clearances.

B. Install ground-mounted units on 4-inch- (100-mm-) thick, reinforced-concrete base. Anchor unit to base using inserts or anchor bolts.

C. Install roof-mounted units on mechanical equipment curb. Anchor unit to structural frame with removable fasteners.

D. Install electrical devices according to NFPA 70.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

0750-1-59 ARCHITECTURAL, BUILDING, REHAB, OTHER BUILDING

END OF SECTION

SECTION 23 7413

PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
   2. Documentation indicating that equipment and refrigerants comply.
   3. Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Performance:
   1. Basic Wind Speed: 140 mph. Building Classification Category: II.
   2. Minimum 10 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. ARI Compliance: ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs; ARI 270 for testing and rating sound performance for RTUs.

C. Comply with ASHRAE 15.
   1. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1 Compliance:
   1. Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
   2. EER: Equal to or greater than scheduled.

E. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

F. Comply with NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

G. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of five years.

2.02 MANUFACTURERS

A. Manufacturers: One of the following:
   1. AAON, Inc.
   2. Addison Products Company.
   3. Carrier Corporation.
   4. Engineered Air.
   5. Lennox Industries Inc.

6. McQuay International.
7. Trane; American Standard Companies, Inc.
8. YORK International Corporation.

2.03 COMPONENTS

A. Casing: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
   1. Exterior Casing: Galvanized steel with factory-painted finish and pitched roof panels.
   2. Inner Casing: Galvanized steel.
   3. Condensate Drain Pans: Comply with ASHRAE 62, insulated double-wall stainless steel.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Fans:
   1. Direct-Driven, Supply-Air Fans: Double width, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet.
   2. Belt-Driven, Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing.
   3. Condenser Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
   4. Relief-Air Fan: Propeller, shaft mounted on permanently lubricated motor.
   5. Fan Motor: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

D. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

E. Electric-Resistance Heating Coil: Open resistance wire supported and insulated by ceramic bushings in galvanized casing with overtemperature and overcurrent protection, magnetic contactors, and step controller.

F. Compressor: Mounted on vibration isolators, internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

G. Refrigeration Specialties:
   1. Refrigerant Charge: R-410A.
   2. Expansion valve with replaceable thermostatic element.
   3. Refrigerant filter/dryer.
   4. Manual-reset high-pressure safety switch.
   5. Automatic-reset low-pressure safety switch.
   6. Minimum off-time relay.
   7. Automatic-reset compressor motor thermal overload.
   8. Brass service valves installed in compressor suction and liquid lines.
   9. Low-ambient kit high-pressure sensor.
   10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.

11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

H. Air Filtration: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Glass Fiber: Minimum 80 percent arrestance, and MERV 5.
2. Pleated: Minimum 90 percent arrestance, and MERV 7.

I. Dampers:
1. Outdoor-Air Damper: Linked damper blades, for zero to 25 percent outdoor air, with manual damper filter.
2. Outdoor- and Return-Air Mixing Dampers: Galvanized-steel dampers with modulating damper motor.

J. Electrical Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

K. Controls:
1. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected.
2. Programmable thermostat with seven day clock and minimum four programmable periods per day.
3. Humidistat: Hot-gas reheat coil control.
4. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
5. Carbon Dioxide Sensor: Reset minimum outdoor-air ratio down to 10 percent to maintain maximum 1000-ppm concentration.

L. Accessories:
1. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
2. Low-ambient kit using staged condenser fans for operation down to 35 deg F (2 deg C).
3. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
4. Coil guards of painted, galvanized-steel wire.
5. Hail guards of galvanized steel, painted to match casing.
6. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.
7. Roof Curb: Minimum 14-inch- (355-mm-) tall roof curb lined with 2-inch- (50-mm-) thick, fiberglass insulation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in strict conformance with the manufacturer's installation and clearance requirements.

B. Install roof curb on roof structure, according to ARI Guideline B or NRCA's "Low-Slope Membrane Roofing Construction Details Manual."

C. Install and secure units on curbs, and coordinate roof penetrations and flashing with roof construction.

D. Install wind and seismic restraints according to manufacturer's written instructions.

E. Attach air ducts to termination in roof curbs.

F. Connect units to electrical power and control wiring systems and to ground.

PART 4 - BASIS OF PAYMENT - ALL OF THE WORK OF THIS SECTION IS INCLUDED UNDER PAY ITEM NO.

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END OF SECTION