

SECTION 13125 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Metal Building System Description: Rigid modular, with interior columns with expandable endwall.
 - 1. Eave Height: 13'-0"
 - 2. Dimensions and Bay Spacings: As indicated
 - 3. Roof Slope: 1 inch per 12 inches (1:12) Field verify and match existing.
- B. Structural Performance: Provide manufacturer's standard metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
 - 1. Engineer metal building systems according to procedures in MBMA's "Low Rise Building Systems Manual."
 - 2. Design Loads: Comply with load requirements of MBMA's "Low Rise Building Systems Manual."
 - 3. Wind-Uplift Resistance of Roof Panel Assemblies: UL 580, Class 90.
- C. Submittals: Product Data, Shop Drawings, structural analysis data signed and sealed by a qualified professional engineer registered in the state where Project is located.
 - 1. Submit letter of design certification, signed and sealed by a qualified professional engineer. Indicate name and location of Project, name of manufacturer, order number, name of contractor, governing building code and standards including year of edition, design loads and load combinations, building use category, and load importance factors.
- D. Comply with AISC S335, "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC S342, "Load and Resistance Factor Design Specification for Structural Steel Buildings"; and AISI SG-671, "Specification for the Design of Cold-Formed Steel Structural Members," or AISI SG-911, "Load and Resistance Factor Design Specification for Steel Structural Members."

PART 2 - PRODUCTS

2.1 METAL BUILDINGS

- A. As Manufactured by the following, or architect approved equal.
 - 1. Varco Pruden
 - 2. Butler
 - 3. MBCI
 - 4. Dean Steel
- B. Structural-Framing Materials: As follows:
 - 1. Structural-Steel Shapes: ASTM A 36/A 36M or ASTM A 529/A 529M.

2. Steel Plate, Bar, or Strip: ASTM A 529/A 529M, ASTM A 570/A 570M, or ASTM A 572/A 572M; 50,000-psi (345-MPa) minimum yield strength.
3. Steel Tubing or Pipe: ASTM A 500, Grade B; ASTM A 501; or ASTM A 53, Grade B.
4. Structural-Steel Sheet: Hot rolled, ASTM A 570/A 570M, Grade 50 or Grade 55; hot rolled, ASTM 568/A 568M; or cold rolled, ASTM A 611, structural quality.
5. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G60 (Z180) coating.
6. Steel Joists and Joist Girders: Comply with SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders," with steel-angle top and bottom chord members.

C. Roof and Wall Panels: As follows:

1. Metal Panels: Steel sheet, zinc coated by the hot-dip process, complying with ASTM A 653/A 653M, G90 (Z275), structural quality, and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
2. Lap-Seam Roof Panels: Metal panels factory formed to provide 36-inch (914-mm) coverage, with raised trapezoidal major ribs at 12 inches (305 mm) o.c., and intermediate stiffening ribs symmetrically spaced between major ribs. Design panels for mechanical attachment to structure using concealed fasteners, lapping major ribs at panel edges.
3. Roof Panel Metal Thickness: [0.0179 inch (0.45 mm)] [0.0239 inch (0.60 mm)] [0.0299 inch (0.75 mm)].
4. Lap-Seam Wall Panels: Metal panels factory formed to provide 36-inch (914-mm) coverage, with raised trapezoidal major ribs at 12 inches (305 mm) o.c., and intermediate stiffening ribs symmetrically spaced between major ribs. Design panels for mechanical attachment to structure using exposed fasteners, lapping major ribs at panel edges.
5. Wall Panel Metal Thickness: 0.0239 inch (0.60 mm).
6. Metal Panel Finish: [Fluoropolymer 2-coat system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a total minimum dry film thickness of 1 mil (0.025 mm) one-modified, polyester-enamel topcoat;
7. Translucent Panels: Glass-fiber-reinforced polyester, complying with ASTM D 3841, Type CC1, limited flammability, Grade 1; weather-resistant, weighing 8 oz./sq. ft. (2441 g/sq. m) for roof panels and 6 oz./sq. ft. (1831 g/sq. m) for wall panels.
8. Panel Accessories: Provide clips, flashings, sealants, gaskets, and similar items. Where roof panels attach directly to purlins, provide 1-inch- (25-mm-) thick extruded-polystyrene thermal spacer blocks.

D. Flashing and Trim: Form from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Finish flashing and trim same as adjacent roof or wall panels.

E. Gutters and Downspouts: Form from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet prepainted with coil coating. Match gutters to profile of gable trim and finish gutters to match roof fascia and rake trim. Finish downspouts to match wall panels.

F. Vinyl-Faced Glass-Fiber-Blanket Insulation: Thermal insulation, complying with ASTM C 991, Type II, 0.5-lb/cu. ft. (8-kg/cu. m) density, with a flame-spread rating of 25 or less, and 3-inch- (75-mm-) wide, continuous, vapor-tight edge tabs.

G. Accessories: As follows:

1. Personnel Doors: Steel doors, 1-3/4 inches (44 mm) thick, with 0.0359-inch- (0.9-mm-) thick, zinc-coated (galvanized) steel face sheets, 0.0598-inch- (1.5-mm-) thick, inverted

channels welded to face sheets at top and bottom of door, and kraft honeycomb core; and steel frames, with 2-inch- (50-mm-) wide faces, fabricated from 0.0598-inch- (1.5-mm-) thick, zinc-coated (galvanized) steel sheet. Prepare and reinforce doors and frames to receive hardware according to DHI A115 Series.

H. Miscellaneous Materials: As follows:

1. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer; complying with performance requirements of FS TT-P-664.
2. Primer for Galvanized Metal Surfaces: Zinc dust, zinc-oxide primer; FS TT-P-641.
3. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
4. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant as recommended by metal building system manufacturer.

PART 3 - EXECUTION

3.1 ERECTION

- A. Setting Baseplates and Bearing Plates: Clean concrete and masonry of bond-reducing materials and roughen surfaces before setting baseplates and bearing plates. Clean bottom surface of baseplates and bearing plates.
1. Set baseplates and bearing plates for structural members on wedges, shims, or setting nuts.
 2. Tighten anchor bolts after supported members have been positioned and plumbed.
 3. Pack grout solidly between bearing surfaces and plates so no voids remain.
- B. Set structural framing in locations and to elevations indicated and according to AISC specifications referenced in this Section.
1. Make field connections for primary framing using high-strength bolts. Tighten bolts by turn-of-the-nut method.
 2. Fasten secondary framing to primary framing using clips and non-high-strength bolts. Hold rigidly to a straight line by sag rods.
 3. Install joists, girders, and accessories according to SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders."
 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- C. Roof Panel Installation: Provide roof panels of full length from eave to ridge when possible.
1. Rigidly fasten eave end of roof panels and allow ridge end free movement.
 2. Install screws with power tools having controlled torque to compress neoprene washer without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 3. Use aluminum or stainless-steel fasteners for exterior and galvanized fasteners for interior.
 4. Locate panel splices over, but not attached to, structural supports; stagger panel splices.
 5. Standing-Seam Roof Panels: Fasten to purlins with concealed clips at each standing-seam joint. Install clips over top of insulation. Crimp standing seams with manufacturer-approved motorized seamer tool. At end splices, lap panels 6 inches (150 mm), seal with butyl sealant and fasten together with interlocking clamping plates.

6. Lap-Seam Roof Panels: Fasten to purlins with exposed fasteners at each lapped joint. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on lap seams. At end splices, lap panels 6 inches (150 mm), seal with butyl sealant and fasten together with interlocking clamping plates.
- D. Wall Panel Installation: Provide panels full height of building when possible.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints.
 2. When two rows of panels are required, lap panels 4 inches (100 mm) minimum. Locate panel splices over structural supports.
 3. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as necessary for waterproofing.
 4. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on lap seams.
 5. Install screws with power tools having controlled torque to compress neoprene washer without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 6. Use aluminum or stainless-steel fasteners for exterior and galvanized fasteners for interior.
- E. Translucent Panel Installation: Attach plastic panels to structural framing with end laps of not less than 6 inches (150 mm) for roof panels and 4 inches (100 mm) for wall panels and side laps of not less than 1-1/2-inch (38-mm). Seal with translucent mastic.
- F. Gutters, Downspouts, Flashing, and Trim Installation: Comply with SMACNA's "Architectural Sheet Metal Manual." Provide for thermal expansion; conceal fasteners where possible, and set units true to line and level. Install work with laps and seams that will be permanently watertight.
- G. Insulation Installation: Install insulation concurrently with panel installation. Set vapor-retarder-faced units with vapor retarder to warm side of construction. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
1. Over-Framing Installation: Extend over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.
 2. Between-Purlin Installation: Extend between purlins. Carry facing up and over purlin, overlapping adjoining facing. Hold in place with bands and crossbands below insulation.
 3. Over-Purlin-with-Spacer-Block Installation: Extend over and perpendicular to top flange of secondary framing members. Install layer of unfaced insulation over first layer to fill space formed by roof panel standoffs. Hold in place by panels fastened to standoffs.
 4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend between purlins. Carry facing up and over purlin, overlapping adjoining facing. Install layer of unfaced insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
- H. Accessory Installation: As follows:
1. Seal perimeter of door frames with elastomeric sealant used for panels.
 2. Install personnel doors and frames straight, level, and plumb. Securely anchor frames to building structure. Set units with maximum 1/8-inch (3-mm) clearance between door and frame at jambs and head and maximum 3/4-inch (19-mm) clearance between door and floor.

3. Sliding Service Door Installation: Bolt support angles to opening head members. Bolt door tracks to support angles at maximum 24 inches (610 mm) o.c. Set doors and operating equipment with necessary hardware, stops, and continuous hood flashing.
4. Install windows level, plumb, and true to line, without warp or rack, anchored securely in place. Set sill members in a bed of sealant and seal perimeter of each unit.
5. Pipe Flashing: Form flashing around pipe penetrations. Fasten and seal to panels.
6. Adjust and check each operating item of hardware to ensure proper operation and function. Replace units that cannot be adjusted to operate freely and smoothly.

END OF SECTION 13125

SECTION 15055 - COMMON PIPING REQUIREMENTS

PART 4 - GENERAL (Not Applicable)

PART 5 - PRODUCTS

5.1 SUPPORTING DEVICES

- A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.
- B. Building Attachments: Powder-actuated-type, drive-pin attachments with pullout and shear capacities appropriate for supported loads and building materials; UL listing and FM approval for fire-protection systems.
- C. Mechanical-Anchor Fasteners: Insert-type attachments with pullout and shear capacities appropriate for supported loads and building materials; UL listing and FM approval for fire-protection systems.

PART 6 - EXECUTION

6.1 INSTALLATION

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.
- C. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
- E. Fire-Barrier Penetrations: Seal pipe penetrations with through-penetration firestop systems specified in Division 7.
- F. Install unions adjacent to each valve and at final connection to each piece of equipment.

- G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas, compressed air, and vacuum piping.
- H. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water and steam piping.

6.2 HANGERS AND SUPPORTS

- A. Install building attachments within concrete or to structural steel. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- B. Install powder-actuated drive-pin fasteners in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.
- C. Install mechanical-anchor fasteners 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.

END OF SECTION 15055

SECTION 15110 – VALVES

PART 7 - GENERAL (Not Applicable)

PART 8 - PRODUCTS

8.1 GENERAL-DUTY VALVES

- A. End Connections: Threads shall comply with ANSI B1.20.1. Flanges shall comply with ANSI B16.1 for cast-iron valves and ANSI B16.24 for bronze valves. Solder-joint connections shall comply with ANSI B16.18.
- B. Gate Valves: Class 125, cast-bronze body and bonnet; with solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing.
- C. Ball Valves: Rated for 150-psig (1035-kPa) saturated steam pressure, 400-psig (2760-kPa) WOG pressure; 2-piece construction; with bronze body, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle.
- D. Plug Valves: Rated at 150-psig (1035-kPa) WOG; bronze body, with straightaway pattern, square head, and threaded ends.
- E. Globe Valves: Class 125; body and screwed cast-bronze bonnet; with brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing.

- F. Swing Check Valves: Class 125, cast-bronze body and cap; with horizontal swing, Y-pattern, and bronze disc.
- G. Valves for Copper Tube: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
- H. Valves for Steel and Plastic Pipe: Threaded ends.

PART 9 - EXECUTION

9.1 INSTALLATION

- A. Use gate and ball valves for shutoff duty; globe and ball for throttling duty.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves for each fixture and item of equipment.
- D. Install three-valve bypass around each pressure-reducing valve using throttling-type valves.
- E. Install valves in horizontal piping with stem at or above center of pipe.
- F. Install valves in a position to allow full stem movement.
- G. Install check valves for proper direction of flow in horizontal position with hinge pin level.

END OF SECTION 15110

SECTION 15130 - PUMPS

PART 10 - GENERAL

10.1 SECTION REQUIREMENTS

- A. Summary: Sewage pumps.
- B. Submittals: Product Data for each pump, including certified pump-performance curves, furnished specialties, motor horsepower and electrical characteristics, and wiring diagrams.
- C. Comply with UL 778 for construction requirements.
- D. NEMA MG 1, "Standard for Motors and Generators," for electric motors. Include NEMA listing and labeling.

PART 11 - PRODUCTS

11.1 MOTORS

- A. Built-in thermal-overload protection and grease-lubricated ball bearings, and shall be non-overloading within full range of pump-performance curves.

11.2 SEWAGE PUMPS

- A. Quick-Disconnect-System, Submersible Sewage Pumps: Submersible, direct-connected sewage pump complying with HI 1.1-1.5 for submersible sewage pumps. Include quick-disconnect system.
1. Pump Arrangement: Simplex
 2. Casing: Cast iron, with cast-iron legs that elevate pump to permit flow into impeller, and discharge companion flange arranged to connect to quick-disconnect-system discharge-elbow fitting.
 3. Impeller: Bronze or stainless-steel impeller, with stainless-steel grinder assembly.
 4. Seals: Double mechanical seals.
 5. Motor: Hermetically sealed, capacitor-start type; with lifting eye or lug; and three-conductor waterproof power cable of length required, with grounding plug and cable-sealing assembly for connection at pump.
 6. Moisture-Sensing Probe: Internal moisture sensor, moisture alarm, and waterproof cable of length required, with cable-sealing assembly for connection at pump.
 7. Controls: NEMA 250, Type 1 enclosure; with two micropressure switches in NEMA 250, Type 6 enclosures; mounting rod; and electric cables.
 8. Manufacturer and model no. shall be as indicated on drawings.

PART 12 - EXECUTION

12.1 INSTALLATION, GENERAL

- A. Install pumps with access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.
- B. Support pumps and piping so weight of piping is not supported by pumps.
- C. Install electrical connections for power, controls, and devices.

12.2 INSTALLATION, SEWAGE

- A. Submersible Sewage Pumps: Set pumps on basin floor. Make direct connections to sanitary drainage piping.
- B. Install swing check valve and gate or ball valve on each sewage pump discharge. Include spring-loaded or weighted-lever check valves for piping NPS 2-1/2 (DN65) and larger.
- C. Install swing check valve and gate or ball valve on each sump pump discharge. Include spring-loaded or weighted-lever check valves for piping NPS 2-1/2 (DN65) and larger.
- D. Install swing check valve and gate or ball valve on each automatic, packaged pump discharge.

END OF SECTION 15130

SECTION 15430 – PLUMBING EQUIPMENT

PART 13 - GENERAL

METAL BUILDING SYSTEMS

13.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Instantaneous Water Heaters: Bear AGA certification label.
- C. Tankless LPG water heaters

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum of three years experience.
- B. Identification: Provide devices with manufactures name, model number, and rating/capacity identified by permanently attached label
- C. Standards: Ensure products and installation of specified products are in conformance with recommendations and requirements of the American Society of Mechanical Engineers, and underwriters Laboratories.

PART 14 - PRODUCTS

14.1 WATER HEATERS, GENERAL

- A. Unit shall be a one piece compact design suitable for an undersink mounting location, and shall be demand only (no storage) UL listed design.
- B. Element: Nichol Chrome element with replaceable cartridge.
- C. Controls: Heating element shall activate on demand via flow switch. Flow switch shall be factory set to activate element at a flow rate which limits the temperature rise to a maximum of 55 degrees farenheit.

2.2 TANKLESS WATER HEATERS - LPG

- A. Approved Manufacturers.
 - 1. The basis of design is Rinnai Corporation. The following manufacturers are approved equal provided they can meet the performance, material and operational features of the basis for design equipment.
 - 2. Rheem
 - 3. Noritz
- B. Units shall be NSF and ASME approved for the application.
- C. The water heater shall provide temperature controlled continuous water flow.
- D. The unit shall incorporate a digital display and control panel.
- E. Operation shall be forced combustion using LP gas. The unit shall incorporate venting of the products of combustion.
- F. The unit shall suitable for outdoor installation with zero clearance of the back of the unit to the exterior wall construction. All components shall be weather protected.
- G. Safety Features
 - 1. Overheat: The appliance will automatically shut down when the appliance exceeds a predetermined temperature.

2. Flame Failure: The appliance will automatically shut down if the burner flame is extinguished.
 3. Power Failure: The appliance will cut off the gas if it loses electrical power.
 4. Power Surge Fuse: A glass fuse protects against over current. If the fuse blows then all indicator lamps will be off.
- Fusible Link: In case the overheat feature does not prevent the temperature from rising then the fusible link will break shutting off the appliance.

H. Accessories & Options

1. Temperature controller MC-91.

I. Warranty: 5 years parts and 1 year labor.

PART 15 - EXECUTION

15.1 INSTALLATION

- A. Install water heaters in accordance with manufacturer's instructions and to UL and other listing requirements.
- B. Coordinate with plumbing piping and related electrical work to achieve operating system.

END OF SECTION 15430

SECTION 15080 - MECHANICAL INSULATION

PART 16 - GENERAL

16.1 SECTION REQUIREMENTS

- A. Submittals: Product Data for each type of mechanical insulation
- B. Quality Assurance: Labeled with maximum flame-spread rating of 25 and maximum smoke-developed rating of 50 according to ASTM E 84.

PART 17 - PRODUCTS

17.1 PIPE INSULATION

- A. Preformed Glass-Fiber Pipe Insulation: ASTM C 547, Class 1, with factory-applied, all-purpose, vapor-retarder jacket.
- B. Flexible Elastomeric Cellular Pipe Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I.
- C. Polyolefin Pipe Insulation: Unicellular polyethylene, preformed pipe insulation. Comply with ASTM C 534, Type I, except for density.
- D. DUCT AND EQUIPMENT INSULATION

- E. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- F. Glass-Fiber-Blanket Insulation: Glass fibers bonded with a thermosetting resin;. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- G. Flexible Elastomeric Cellular Sheet Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II.

EXECUTION

17.2 INSTALLATION

- A. Install vapor barriers on insulated pipes with surface operating temperatures below 60 deg F (15 deg C).
- B. Insulate fittings, valves, and specialties.
- C. Seal vapor-barrier penetrations for hangers, supports, anchors, and other projections.
- D. Coat glass-fiber pipe insulation ends with vapor-barrier coating.
- E. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing.
- F. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal.
- G. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- H. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal around penetration with through-penetration firestop systems specified in Division 7.
- I. Floor Penetrations: Terminate insulation at the underside of the floor assembly and at the floor support at top of floor. Seal around penetration with through-penetration firestop systems specified in Division 7.
- J. Glass-Fiber Insulation Installation: Bond insulation to pipe with adhesive. Seal seams and joints with vapor-barrier compound.
- K. Flexible Elastomeric Insulation Installation: Seal joints with adhesive.
- L. Interior Piping System Applications: Insulate the following piping systems:
 - 1. Domestic hot water.
 - 2. Refrigerant suction piping.
- M. Do not apply insulation to the following systems, materials, and equipment:
 - 1. Flexible connectors.

2. Sanitary drainage and vent piping.
 3. Below-grade piping.
 4. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
 5. Piping specialties, including air chambers, unions, strainers, check valves, plug valves, and flow regulators.
- N. Pipe Insulation Thickness Application Schedule: Insulate piping with the following materials and thicknesses:
1. Domestic Hot Water and Recirculated Hot Water: 1/2-inch (12.7-mm)[preformed glass-fiber or flexible elastomeric pipe insulation.
 2. Suction Piping: 3/4-inch (19-mm) flexible elastomeric pipe insulation
- O. Install duct insulation as follows:
1. Install insulation continuously on ducts that penetrate walls and floors, except at fire-rated assemblies terminate insulation at the assembly. Maintain insulation vapor retarder on cold duct.
 2. Install removable or segmented insulation on access panel and doors.
 3. Install vapor barriers on insulated ducts and plenums with surface operating temperatures below 60 deg F (15 deg C). Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.
 4. Taper glass-fiber insulation ends at a 45-degree angle and seal with adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.
 5. Board Insulation Installation: Secure insulation tight and smooth with speed washers and anchor pins. Space anchor pins 18 inches (450 mm) apart each way and 3 inches (76 mm) from insulation joints. Apply vapor-barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in vapor barrier.
 6. Blanket Insulation Installation: Bond ducts having long sides or diameters smaller than 24 inches (610 mm) with bonding adhesive applied in 6-inch- (150-mm-) wide transverse strips on 12-inch (300-mm) centers. Bond ducts having long sides or diameters 24 inches (610 mm) and larger with anchor pins spaced 12 inches (300 mm) apart each way. Apply bonding adhesive to prevent sagging of insulation. Overlap joints 3 inches (76 mm). Seal joints, breaks, and punctures with vapor-barrier compound.
- P. Duct System Applications: Insulate indoor concealed supply-, return-, and outside-air ducts.
- Q. Do not apply insulation to the following systems, materials, and equipment:
1. Fibrous glass ducts.
 2. Metal ducts with duct liner.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 5. Vibration-control devices.
 6. Testing laboratory labels and stamps.
 7. Nameplates and data plates.
- R. Duct Insulation Thickness and Application Schedule: Insulate ducts with the following materials and thicknesses:
1. Concealed Applications: Fiberglass blanket, 1-1/2 inches (38 mm) thick or Fiberglass board, 2 inches (50 mm) thick.
 2. Exposed Applications: Fiberglass board, 2 inches (50 mm) thick.

END OF SECTION 15080

SECTION 15835 FANS

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section applies to all fans shown on the Drawings and specified in other sections.

1.02 SUBMITTALS

A. Submit product data and complete performance data to include noise levels.

B. Submit performance curves for fans of 1/2 horsepower or greater.

C. Submit tabular performance data for fans less than 1/2 horsepower.

D. Installation details for exterior and roof-mounted fans and/or curbs, which meet the Building Code wind load requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Fan data shall be AMCA rated, tested and certified for air and sound performance. All fans shall be UL approved.

B. Fans shall be selected to operate in the stable region of their characteristic performance curve.

C. Equipment submitted shall be equal in all respects and provide the materials of construction and all standard features; scheduled or specified options or accessories of the equipment specified and scheduled on the drawings.

D. All fan wheels shall be statically and dynamically balanced. Fan operation shall be free of undue noise and vibration at design conditions and throughout the fans normal selection range.

E. Fan drives shall be direct or belt type as scheduled. Belt drives shall be adjustable and sized to transmit 150 percent of motor horsepower.

F. Motors shall be provided with electrical characteristics scheduled on the Drawings. All motors shall meet the requirements of Division 16 and shall provide overload protection and a minimum service factor of 1.15.

G. Furnish fan accessories as scheduled on the Drawings to include disconnects, roof curbs, dampers, caps, and special finishes.

2.01 CABINET CENTRIFUGAL FANS

A. Fan shall be fully enclosed, forward curved centrifugal type of galvanized steel construction.

B. Performance and drives shall be as scheduled on the Drawings.

C. Fan shall be rigidly constructed to resist torsional stresses; free from objectionable vibration or noise; statically and dynamically balanced and capable of operating at speed not less than 1-1/2 times the required operating speed.

D. Housing shall be constructed of heavy gage galvanized steel with one inch thick fiberglass lining meeting NFPA 90 A requirements. The housing shall be capable of modification for bottom inlet on in-line application.

E. Fan discharge opening shall be provided with a backdraft damper unless indicated otherwise on the Drawings.

F. Cabinet inlet shall be provided with a one-piece plastic or aluminum grille with enamel finish and sight proof appearance.

G. Provide non-fused disconnect switch complete with factory wiring and mounting.

- H. Where scheduled provide wall or roof jacks constructed of .063 inch aluminum with continuous welded watertight seams. Roof jack shall be of the roofed-over flashing type. Wall jacks shall have a flanged frame. Provide jacks with bird screens.
- I. Provide a variable speed controller with dial and cover plate where scheduled on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fans where indicated in accordance with the manufacturer's instructions and the Drawings.
- B. Provide vibration isolation where indicated on the Drawings or specified in other sections of the Specifications.

3.02 START UP

- A. Verify proper electrical connection to the fan motor and assure proper fan wheel rotation upon start up.
- B. Assure fan bearings are properly lubricated before start up.
- C. Check fan for undue vibration or noise during operation.
- D. Adjust fan speed at drive or speed controller to achieve specified performance.

END OF SECTION 15835