
SECTION 15250 - INSULATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to insulate the heating, ventilating, air conditioning and plumbing systems.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 15000, Supplemental General Mechanical Requirements and the entire project manual are hereby made a part of the work of this section.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels, unless specifically listed below as an unfinished space.
- B. Unfinished Spaces: Boiler Rooms, Mechanical rooms and Elevator machine rooms.
- C. Unconditioned Spaces: Spaces exposed to near outside ambient temperatures, such as unheated attic spaces or non-air conditioned areas.
- D. Outside: Areas beyond the exterior side of walls or above the roof, unexcavated spaces, and crawl spaces.
- E. Concealed: Not visible in finished or unfinished spaces. For example, above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.
- F. Exposed: Visible from a finished or unfinished space.

1.4 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 15000-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 15000, Supplemental General Mechanical Requirements, apply are as follows:
 - 1. Piping insulation.
 - 2. Duct insulation.
 - 3. Equipment insulation.
 - 4. Insulation application schedule.
 - 5. Firestopping.
 - 6. Metal and PVC jacketting.
 - 7. Vapor barrier coating (mastic).

1.5 MANUFACTURER'S STAMP OR LABEL

- A. Packages or standard containers of insulation, jackets, cements, adhesives, and coatings delivered to the project site for use must have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material. Insulation shall be asbestos-free.

1.6 FLAME SPREAD AND SMOKE DEVELOPED RATINGS

- A. Materials shall have a flame-spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with NFPA 255, ASTM E84, or UL 723.
- B. Provide materials with flame resistant treatments not subject to deterioration due to aging, moisture, high humidity, oxygen, ozone, or heat.
- C. Materials Exempt From Fire-Resistant Rating: Nylon anchors for securing insulation to ducts or equipment.

PART 2 PRODUCTS

2.1 PIPING INSULATION

- A. Fiberglass: Heavy density preformed fiberglass with thermal conductivity of 0.29 Btu-in/hr-ft²-°F at 150°F mean temperature. Insulation shall conform to ASTM C547 Class I and shall be suitable for 450°F service. Fitting insulation shall be of same material used for pipe.
 - 1. Insulation Jacket: All service (ASJ) type conforming to Fed. Spec. HH-B-100B Type I. Jacket permeability shall not exceed 0.02 perms (ASTM E96). Pipe fitting jacket shall be factory premolded, one-piece, PVC covers with pressure sensitive taped joints. Jackets in exposed locations shall have a white surface suitable for field painting. Provide vapor barrier as required by service.
 - 2. Aluminum Jackets: ASTM B 209M (ASTM B 209), Temper H14, minimum thickness of 27 gage (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide 1/2" wide stainless steel bands. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.
 - 3. PVC Jacket: ASTM 1784, minimum thickness 0.030", over insulation and vapor barrier. Jacket shall be overlapped 2" minimum on down side.
- B. Flexible Unicellular: Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft²-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type I, Tubular and shall be suitable for 200°F service. Fitting insulation shall be of same material used for pipe. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.
- C. Fittings, Flanges, and Valves: Provide insulation for fittings, flanges, and valves premolded, precut, or job fabricated of the same thickness and conductivity as used on adjacent piping.
- D. Insulation Kit: Insulate exposed supply and waste piping at handicapped accessible sinks with fully molded insulation kit. McGuire Products ProWrap, 3/16" thick closed vinyl with anti-microbial additive, 1.02 Btu-in/hr-F²-°F thermal conductivity, white color.

2.2 DUCT INSULATION

- A. Fiberglass (Ductwrap): Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density (0.75 lb/cu.ft. for 3" thickness only), 0.29 Btu-in/hr-ft²-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.
- B. Fiberglass (Ductboard): Fiberglass insulation board with foil-scrim-kraft facing/vapor barrier, 3.0 lb./CF density, 0.25 Btu-in/hr-ft²-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A and B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.

2.3 EQUIPMENT INSULATION

- A. Fiberglass (Hot Equipment): Semi-rigid fiberglass board conforming to Fed. Spec. HH-I-558B, Form B, Type I. Thermal conductivity shall be 0.32 Btu-in/hr-ft²-°F at 150°F mean temperature (ASTM C177), insulation shall be suitable for 650°F service. Insulation jacket shall be "all service" type conforming to Fed. Spec. HH-I-100B Type I or II. Jacket permeability shall not exceed 0.02 perms (ASTM E96).
- B. Flexible Unicellular (Cold Equipment): Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft²-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type II, sheet and shall be suitable for 200°F service. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

2.4 EXTERIOR HEAT-TRACED PIPING

- A. All water and sanitary service piping located in the cavity below the ramp and the pier level of the building and otherwise exposed to freezing temperatures, as indicated, shall be heat-traced and insulated as specified to a point 5'-0" below grade and to a point 2'-0" inside the building or other heated space.
- B. Fiberglass: Semi-rigid fiberglass pipe insulation conforming to Fed. Spec. HH-I-558B, Form B, Type I. Thermal conductivity shall be 0.32 Btu-in/hr-ft²-°F at 150°F mean temperature (ASTM C177), insulation shall be suitable for 650°F service. Insulation jacket shall be "all service" type conforming to Fed. Spec. HH-I-100B Type I or II. Jacket permeability shall not exceed 0.02 perms (ASTM E96).
- C. This piping and insulation shall be protected with .030" thick PVC jacketing with cemented joints, or approved equal.

2.5 VAPOR BARRIER COATING

- A. Raw (cut) ends of fiberglass pipe insulation shall be finished (protected) with the application of a suitable vapor barrier coating or finishing cement (mastic) to maintain the continuous visual and functional integrity of the insulation jacket. Mastic shall be Childers "Chil-Perm" CP-30, elastomeric resin, or approved equal, applied in accordance with the manufacturers recommendations.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
2. Verify that the insulation systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 GENERAL

A. Insulate after system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and are dry.

B. Install insulation with jackets drawn tight and cement down longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems and pipe penetrations through fire rated assemblies. Extend surface finishes to protect ends, and raw edges of insulation. Apply vapor barrier coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Keep insulation dry during the application of the finish. Bevel and seal the edges of exposed insulation with vapor barrier coating.

C. Unless otherwise indicated, do not insulate the following:

1. Factory preinsulated flexible ductwork.
2. Factory pre-insulated ductwork, plenums, casings, mixing boxes, and filter boxes.
3. Chrome plated pipes and fire protection pipes.
4. Vibration isolating connections
5. Adjacent insulation
6. ASME stamps, nameplates, access plates
7. Ductwork exposed to view in a normally occupied space.
8. Hydronic specialties: Low water cutoff, relief valves, relief valve discharge piping, pressure reducing valves, and expansion tanks.
9. Unions and flanges at equipment required for frequent service.

3.3 PIPING INSULATION

A. Pipe Insulation (Fiberglass): Place sections of insulation around the pipe and joints, tightly butt into place. Draw jacket laps tight and smooth. Secure jacket with fire resistant adhesive, or factory applied self sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps. Seal exposed ends of insulation with a vapor barrier coating.

B. Flanges, Unions, Valves and Fittings Insulation (Fiberglass): Factory fabricated removable and reusable insulation covers. Place factory premolded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling or with metal or plastic tacks made for securing PVC fitting covers and secure with PVC vapor barrier tape.

- C. Pipe Insulation (Flexible Unicellular): Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Insulate flanges, unions, valves, and fittings.
- D. Where penetrating roofs and exterior walls, insulate piping to a point flush with the underside of the deck or wall and seal with a vapor barrier coating.
- E. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields (16 gage maximum). For fiberglass insulation systems on pipe sizes 2 inches through 3", provide insulation inserts at points of hangers and supports. Insulation inserts shall be of molded glass fiber (minimum 12 pcf). Insulation inserts shall cover the bottom half of the pipe circumference, 180 degrees, and be not less than 4" long. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation. Insulation inserts for pipe sizes 4" and larger shall be welded pipe saddles. Install insulation in void area of saddle of same material used on adjacent insulation. For pipe sizes 2" and smaller, insulation inserts for flexible unicellular insulation systems shall be wooden doweling set on end of length equal to insulation thickness. Seal dowel to insulation with adhesive.
- F. PVC or Metal Jackets: Provide over insulation. Machine cut jacket to smooth edge of circumferential joints. Overlap metal jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9 inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by insulation manufacturer for weatherproofing. Solvent weld PVC jacket system to provide continuous watertight seal.

3.4 DUCT INSULATION

- A. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Each pin or anchor shall be capable of supporting a 20-pound load. Cut off protruding ends of pins. After installing washers, provide foil-scrim-kraft (FSK) tape to seal break in vapor barrier, tape shall extend 1" minimum around pin. Apply insulation with joints tightly butted. Bevel insulation around nameplates and access plates and doors. Seal joints with FSK tape. Provide additional adhesive or staples to assist tape adhesion in difficult applications.
- B. Flexible Blanket Insulation: Apply insulation with joints tightly butted. Staple laps of jacket with outward clinching staples and seal with foil scrim kraft (FSK) tape. Sagging of flexible duct insulation shall not be permitted. For ductwork over 24-inches wide on horizontal duct runs, provide pins, washers and clips. Install speed washers with pins and pin trimmed to washer. Cut off protruding ends of pins after clips are secured. Seal with FSK tape, extend tape 1" minimum around pin. Use pins on sides of vertical ductwork being insulated. Space pins and clips on 18 inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers.
- C. Exposed supply ductwork in finished spaces shall be insulated double-wall construction, as specified, without exterior ductwrap. See Specification Section 15800.

3.5 EQUIPMENT INSULATION

- A. General Procedures: Apply equipment insulation suitable for temperature and service to fit as closely as possible to equipment. Join sections of insulation with adhesive. Bevel insulation around

nameplates, ASME Stamp, and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Provide vapor barrier seal at joints and seams for "cold" equipment.

- B. Heating Equipment: Provide semi-rigid mineral fiberboard insulation. Seal longitudinal and lateral seams with FSK tape. Bond cuts, ends, and mitered sections with adhesive. Provide a vinyl-acrylic mastic coating on exposed fiberglass ends. Heat exchangers / converters shall have two (2) layers of rewettable fiberglass cloth and mastic over the insulation.
- C. Cold Equipment: Provide flexible unicellular sheet insulation, bond cuts, butt joints, longitudinal joints and ends with vapor barrier adhesive. Vapor seal exposed edges to equipment.

3.6 INSULATION APPLICATION SCHEDULE

| <u>SERVICE</u> | <u>THICKNESS</u> | <u>MATERIAL/JACKET</u> |
|-----------------------------------------------------------------------------------------------|------------------|------------------------------------------|
| PIPING: | | |
| Interior Domestic Cold Water Piping 1" and smaller | 1/2" | Fiberglass w/ASJ or Flexible Unicellular |
| 1-1/4" and larger | 1" | Fiberglass w/ASJ or Flexible Unicellular |
| Domestic Hot Water Piping and Domestic Hot Water Recirculation Piping 2" and smaller | 1" | Fiberglass w/ASJ or Flexible Unicellular |
| Water and Drain Piping Under Handicap Accessible Fixtures | | Insulation Kit |
| Domestic Water Branch Piping Less than 10 ft in Stud Walls | 1/2" | Fiberglass w/ASJ or Flexible Unicellular |
| Domestic Water Branch Piping Less than 10 ft in block walls | 1/2" | Flexible Unicellular |
| Horizontal and Vertical Rain Leaders and Roof Drain Sump Bodies | 1/2" | Flexible Unicellular |
| Hot Water Heating Supply and Return Piping Mains All sizes | 1" | Fiberglass w/ASJ |
| Hot Water Heating Supply and Return Branch Piping Less than 10 ft in Stud Walls | 1" | Fiberglass w/ASJ |

| <u>SERVICE</u> | <u>THICKNESS MATERIAL/JACKET</u> | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------|
| PIPING: | | |
| Hot Water Heating Supply and Return Branch Piping Less than 10 ft in Block Wall | 1" | Flexible Unicellular |
| Chilled Water Supply and Return Piping All sizes (Interior) | 2" | Fiberglass w/ASJ |
| Chilled Water Supply and Return Piping All sizes (Exterior) | 2" | Fiberglass w/ASJ and Aluminum jacketing |
| Condensate Drain Piping Inside Building | 1/2" | Flexible Unicellular |
| Exterior Cold Water Piping (Heat-traced) All sizes | 1" | Fiberglass w/ASJ |
| Sanitary Force Mains (Heat-traced) All sizes | 1" | Fiberglass w/ASJ |
| Generator exhaust system | 2" | Calcium silicate w/ Rewettable cloth and mastic |
| Sewage Ejector Tank | 3/4" | Flexible unicellular |
| DUCTWORK/BREECHING: | | |
| Acoustically Lined Ductwork: Unless indicated otherwise, acoustical duct liner shall be 1" thick. Acoustically lined supply ductwork in unconditioned spaces (such as mechanical rooms) shall be insulated as specified below. | | |
| Concealed Supply Ductwork from the ERV's to Spaces Served (in conditioned spaces) | 1-1/2" | Ductwrap, FSK |
| Return Ductwork from the Spaces Served to the ERV's (in conditioned spaces) | N.A. | N.A. |

| <u>SERVICE</u> | <u>THICKNESS</u> | <u>MATERIAL/JACKET</u> |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------|
| DUCTWORK/BREECHING: | | |
| Supply and Return Ductwork (rectangular) in unconditioned spaces (Such as mechanical spaces) | 1" | Ductboard, FSK |
| Supply and Return Ductwork (Round or Flat Oval) in unconditioned spaces (Such as mechanical spaces) | 1-1/2" | Ductwrap, FSK |
| Outside Air Intake Ductwork (Rectangular) from the intake louver to the ERV's | 3" | Ductboard, FSK |
| Outside Air Intake Ductwork (Round or Flat Oval) from the intake louver to the ERV's | 3" | Ductwrap, FSK |
| Combustion Air Ductwork | 3" | Ductboard, FSK |
| Plenums at Intake and Exhaust louvers | 3" | Ductboard, FSK |
| Exhaust Ductwork from a point three (3) feet interior of the motorized control damper or backdraft damper to the exterior wall, roof, or louver. | 3" | Ductboard, FSK |
| EQUIPMENT | | |
| Water Meter | 1/2" | Flexible Unicellular |
| Backflow Preventer | 1/2" | Flexible Unicellular |
| Heating System Air Separators | 1-1/2" | Fiberglass, ASJ |
| Heat Exchangers/Converters | 2" | Fiberglass, ASJ |
| Suction Diffusers, Air Separators, Flexible Connectors, Valves | 1/2" | Flexible Unicellular |

| | <u>SERVICE</u> | <u>THICKNESS</u> | <u>MATERIAL/JACKET</u> |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------|
| | EQUIPMENT: | | |
| | Chilled Water System Pumps / Air Separators, Storage tank | 1-1/2" | Fiberglass, ASJ |
| 3.8 | FIELD INSPECTION | | |
| | A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements. | | |
| 3.9 | FIRESTOPPING | | |
| | A. Firestopping shall be performed in accordance with Specification Section 07840 "Firestopping and Smoke Barrier Caulking". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified. | | |

* END OF SECTION *