

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC piping insulation, jackets and accessories.
2. HVAC equipment insulation, jackets and accessories.

B. Related Documents:

1. Drawings and general provisions of the contract, including General and Supplementary conditions and Division 01 specification sections, apply to this section and the other sections of this Division.
2. Other sections of this Division, and of other Division, may contain requirements that relate to this section.

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

B. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
2. UL 1978 - Standard for Safety for Grease Ducts.

1.3 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL 723, and NFPA 255. All items exposed in return air plenums must not exceed 25/50 for flame and smoke.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

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- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Perform Work in accordance with applicable local and state codes.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period recommended by manufacturer.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. CertainTeed.
 - 2. Knauf.
 - 3. Johns Manville.
 - 4. Owens-Corning.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Armacell, LLC. Armaflex.

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3. Nomaco. K-flex.
- C. Manufacturers for Polyisocyanurate Foam Insulation Products:
 1. Dow Chemical Company.
- D. Manufacturers for Extruded Polystyrene Insulation Products:
 1. Dow Chemical Company.

2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.
 1. Thermal Conductivity: 0.23 at 75 degrees F (0.034 at 24 degrees C).
 2. Operating Temperature Range: 0 to 850 degrees F (minus 18 to 454 degrees C).
 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
 4. Jacket Temperature Limit: minus 20 to 150 degrees F (minus 29 to 66 degrees C).

2.3 PIPE INSULATION JACKETS

- A. PVC Plastic Pipe Jacket:
 1. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
 2. Thickness: 30 mil (0.76 mm).
 3. Connections: Brush on welding adhesive.
- B. ABS Plastic Pipe Jacket:
 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 2. Minimum service temperature: -40 degrees F (-40 degrees C).
 3. Maximum service temperature of 180 degrees F (82 degrees C).
 4. Moisture vapor transmission: ASTM E96; 0.012 perm-inches.
 5. Thickness: 30 mil (0.76 mm).
 6. Connections: Brush on welding adhesive.
- C. Aluminum Pipe Jacket:
 1. ASTM B209.
 2. Thickness: 0.032 inch (0.80 mm) thick sheet.
 3. Finish: Embossed.
 4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
 5. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
 6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.020 inch (0.50 mm) thick stainless steel.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches (40 mm) diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Piping 2 inches (50 mm) diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches (150 mm) long, matching thickness and contour of adjoining insulation.
- E. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- F. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- G. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- H. Adhesives: Compatible with insulation.

2.5 EQUIPMENT INSULATION

- A. TYPE E-8: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F (0.039 at 25 degrees C).
 - 2. Operating Temperature Range: Range: Minus 70 to 220 degrees F (minus 57 to 105 degrees C).

2.6 EQUIPMENT INSULATION JACKETS

- A. PVC Plastic Equipment Jacket:
 - 1. Product Description: ASTM D1784, sheet material, off-white color.
 - 2. Minimum Service Temperature: -40 degrees F (-40 degrees C).
 - 3. Maximum Service Temperature: 150 degrees F (66 degrees C).
 - 4. Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.
 - 5. Thickness: 30 mil (0.75 mm).
 - 6. Connections: Brush on welding adhesive.
- B. Aluminum Equipment Jacket:
 - 1. ASTM B209.
 - 2. Thickness: 0.040 inch (1.00 mm) thick sheet.
 - 3. Finish: Smooth.
 - 4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
 - 5. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

- C. Canvas Equipment Jacket: UL listed, 6 oz/sq yd (220 g/sq m), plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

2.7 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- E. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Glass Fiber Board Insulation:

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1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
 3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.
- E. Polyisocyanurate Foam Insulation and Extruded Polystyrene Insulation:
1. Wrap elbows and fitting with vapor retarder tape.
 2. Seal butt joints with vapor retarder tape.
- F. Hot Piping Systems less than 140 degrees F (60 degrees C):
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- G. Inserts and Shields:
1. Piping 1-1/2 inches (40 mm) Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 2. Piping 2 inches (50 mm) Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches (150 mm) long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
 3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
- H. Insulation Terminating Points:
1. Coil Branch Piping 1 inch (25 mm) and Smaller: Terminate hot water piping at union upstream of the coil control valve. On VAV, CV, and FTU terminal units, insulate heating water piping and components up to coil connections.
 2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
 3. Cooling Coil Condensate Piping: Insulate entire piping system and components to prevent condensation.
- I. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
 2. Miter joints at elbows.

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3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.
 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with PVC jacket and fitting covers.
- K. .
- L. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- D. Equipment Containing Fluids Below Ambient Temperature:
1. Insulate entire equipment surfaces.
 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 4. Finish insulation at supports, protrusions, and interruptions.
- E. Equipment Containing Fluids 140 degrees F (60 degrees C) Or Less:
1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
 3. Finish insulation at supports, protrusions, and interruptions.
- F. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting or with aluminum jacket.
- G. Cover cellular glass, hydrous calcium silicate, and cellular foam insulation with aluminum jacket.
- H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- J. Prepare equipment insulation for finish painting. Refer to Division 09.

3.4 SCHEDULES

A. Cooling Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPES	PIPE SIZE	INSULATION THICKNESS inches (mm)
Chilled Water Supply and Return [above 40 degrees F]	P-1 ^b	1-1/4 inches (32 mm) and smaller	0.5 (13)
		1-1/2 inches (40 mm) inch and larger	1.0 (25)
Chilled Water Supply and Return [less than 40 degrees F]	P-1 ^b	3/4 inch (20 mm) and smaller	0.5 (13)
		1 inch (25 mm) to 6 inches (150 mm)	1.0 (25)
		8 inches (200 mm) and larger	1.5 (40)
Glycol Supply and Return [40 to 60 degrees F]	P-1 ^b	1-1/4 inches (32 mm) and smaller	0.5 (13)
		1-1/2 inches (40 mm) inch and larger	1.0 (25)

Notes:

- a. Not all insulation types listed are allowed in return air plenums. Insulation in air plenums must have a flame and smoke rating of 25/50 or less per ASTM E84.
- b. Insulation type P-5, P-9, or P-10 may be used for piping installed outdoors. Install longitudinal seams on the bottom of the pipe to allow moisture to drain.

B. Equipment Insulation Schedule:

EQUIPMENT	INSULATION TYPES	INSULATION THICKNESS inches (mm)
Chilled Water Pump Bodies	E-8	0.5 (13)
Chilled Water Air Separators	E-8	0.5 (13)
Chilled Water Expansion Tanks	E-8	0.5 (13)
Chiller Cold Surfaces (Not Factory Insulated)	E-8	1.0 (25)

END OF SECTION 230700