

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

- A. Provide certificates to show that all products meet the following requirements.
 - 1. American Iron and Steel (AIS)
 - 2. Build America, Buy America Act
- B. See Supplementary Conditions for details.

1.02 SUMMARY

- A. Section Includes:
 - 1. Plumbing piping insulation, jackets and accessories.
 - 2. Plumbing equipment insulation, jackets and accessories.
 - 3. Process plumbing exterior insulation, jackets, and accessories.

1.03 REFERENCES

- A. ASTM International:
 - 1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 3. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - 4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
 - 5. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - 6. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
 - 7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - 8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
 - 10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - 12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
19. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
20. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Fire Protection Association:

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

C. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.08 WARRANTY

- A. Section 017700 – Closeout Procedures: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for manmade fiber.

PART 2 - PRODUCTS

2.01 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.
 - 3. Nomaco. K-flex.
- C. Manufacturers for Polyisocyanurate Foam Insulation Products:
 - 1. Dow Chemical Company.
 - 2. Johns Manville.
- D. Manufacturers for Extruded Polystyrene Insulation Products:
 - 1. Dow Chemical Company or approve equal.

- E. Manufacturers for Aluminum Jacketing Products:
 - 1. Johns Manville or approved equal.

2.02 INTERIOR PLUMBING PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
 - 1. Thermal Conductivity: 0.23 at 75 deg F
 - 2. Operating Temperature Range: 0 to 850 deg F
 - 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 deg F
- B. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 deg F
 - 2. Operating Temperature Range: Range: Minus 70 to 180 deg F

2.03 INTERIOR PLUMBING PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
 - 1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- B. Aluminum Pipe Jacket:
 - 1. ASTM B209.
 - 2. Thickness: 0.016 inch thick sheet.
 - 3. Finish: Embossed.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.04 INTERIOR PLUMBING PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches 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 diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self adhesive closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- I. Adhesives: Compatible with insulation.

2.05 EXTERIOR PROCESS PIPE INSULATION

- A. Insulation shall be polyisocyanurate insulation:
 - a. Density: greater than 2.7 lbs/ft³
 - b. "K" Factor: 0.19 Btu-in/hr-ft² -°F @ 75°F
 - c. Compressive Strength: greater than 30 psi @ 75°F
 - d. Closed Cell Content: greater than or equal to 85%
 - e. Thickness: 2 inches
- B. Exterior pipe insulation shall include a heat trace channel.

2.06 EXTERIOR PROCESS PIPE INSULATION JACKETS

- A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.
- B. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Thickness: minimum 0.024 inch thick.
 - b. Finish: Jacketing shall have a smooth, stucco embossed, or corrugated finish
 - c. Moisture Barrier for Outdoor Applications: 3-mil- thick polysurlyn.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Flange and union covers.
 - 4) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- C. Banding for jacketing shall be 0.02" thick by 1/2" wide stainless steel or as specified by manufacturer.
- D. Sealant shall be per manufacturer's specifications.
- E. Vapor Retarder Film or Tape: Compatible with insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 013000 – Project Management and Coordination: Coordination and project conditions.
- B. Verify piping has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.
- D. Prepare surfaces and install insulation, jacketing, and accessories in accordance with manufacturer's recommendations, building codes, and industry standards.

3.02 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 Section 078413 – Penetration Firestopping for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Hot Piping Systems Greater Than 140 deg F:
 - 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. Insulate flanges and unions at equipment.
 - 4. Insulation shall be continuous at all hangers, supports, penetrations or clamps.
 - 5. Exception: Branch piping serving finned tube from below shall not require full insulation through the floor pipe penetration. Contractor to install mineral wool or ½" insulation in interstitial space. The openings shall be sleeved.
- D. Inserts and Shields:
 - 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 - 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.

- b. Insert Material: Approved compression resistant insulating material suitable for planned temperature range and service.
 - 1) Hydrous calcium silicate pipe insulation, rigid molded white; asbestos free.
 - 2) Polyurethane Core System: 5 pcf density, 72 psi compressive strength. K-Flex 360 or approved equal.
 - 3) Wood blocks are not acceptable.
 - c. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts. Shields shall extend a minimum of 6 inches beyond hanger in both directions.
 - 3. Piping Supported by Roller Type Pipe Hangers: Install steel shield between roller and inserts.
- E. Insulation Terminating Points:
- 1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
- F. Closed Cell Elastomeric Insulation:
- 1. Push insulation on to piping.
 - 2. Miter joints at elbows.
 - 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.
- G. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- H. Install removable insulation covers at locations indicated. Installation shall conform to the following:
- 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Finish exposed surfaces with a metal jacket.
- I. Install metal jackets to be waterproof and weather-tight. Install, secure, and seal jacketing per manufacturer's specifications.
- 3.03 Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof

sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

- 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 Over 140 deg F:
 - 1. Insulate flanges and unions with removable sections and jackets.
 - 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.
 - E. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 - F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
 - G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
 - H. Prepare equipment insulation for finish painting. Refer to Section 099123 – “Interior Painting.”

3.04 SCHEDULES

- A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Domestic Cold Water	P-1 or P-5	1-1/4 inches and smaller	0.5
		1-1/2 inches and larger	1.0
Fuel Oil Supply and Return	P-1 or P-5	1-1/4 inches and smaller	0.5
		1-1/2 inches and larger	1.0

END OF SECTION