

SECTION 40 42 13
PROCESS PIPING INSULATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers Inc. (ASHRAE): 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.
2. ASTM International (ASTM):
 - a. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - b. C165, Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
 - c. C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - d. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - e. C534/C534M, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - f. C547, Standard Specification for Mineral Fiber Pipe Insulation.
 - g. C552, Standard Specification for Cellular Glass Thermal Insulation.
 - h. C585, Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
 - i. C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - j. C1729, Standard Specification for Aluminum Jacketing for Insulation.
 - k. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - l. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
3. International Code Council (ICC): International Energy Conservation Code (IECC).
4. UL.

1.02 SUBMITTALS

- A. Action Submittals: Manufacturer's descriptive literature.
- B. Informational Submittals: Maintenance information.

PART 2 PRODUCTS

2.01 PIPE AND FITTING INSULATION

- A. Type 1—Elastomeric:
 - 1. Manufacturers and Products:
 - a. Nomaco; K-Flex.
 - b. Or equal.
 - 2. Physical Characteristics:
 - a. Material: Flexible elastomeric pipe insulation, closed-cell structure in accordance with ASTM C534/C534M.
 - b. Nominal Density: 3 pcf to 6 pcf.
 - 3. Functional Characteristics:
 - a. Joints: Manufacturer's adhesive.
 - 4. Performance Characteristics:
 - a. Temperature Rating: Minus 297 degrees F to 220 degrees F.
 - b. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.25 Btu-in./hr-square foot degrees F at 75 degrees F per ASTM C177 or ASTM C518.
 - c. Maximum water vapor transmission of 0.06 perm-inch per ASTM E96/E96M, Procedure A.
 - d. Flame Spread Rating: Less than 25 per ASTM E84.
 - e. Smoke Developed Index: Less than 50 per ASTM E84.
- B. Type 2—Fiberglass:
 - 1. Manufacturers and Products:
 - a. John Manville; Micro-Lok with Jacket.
 - b. Or equal.
 - 2. Physical Characteristics:
 - a. Material: UL rated, preformed, sectional bonded fiberglass per ASTM C585 with factory applied, Kraft paper with aluminum foil vapor barrier jacket with pressure-sensitive, self-sealing lap.
 - 3. Functional Characteristics:
 - a. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.

4. Performance Characteristics:
 - a. Insulation Temperature Rating: 0 degree F to 850 degrees F.
 - b. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.23 Btu in./hr square foot degrees F at 75 degrees F.
 - c. Jacketing per ASTM C1136 with minimum water vapor transmission for jacket of 0.02 perm-inch per ASTM E96/E96M. Furnish with no jacket if field finish system specified.
 - d. Flame Spread Rating: Less than 25 per ASTM E84.
 - e. Smoke Developed Index: Less than 50 per ASTM E84.

C. Type 3—Foamglass:

1. Manufacturers and Products:
 - a. Pittsburgh Corning; Foamglas One.
 - b. Or equal.
2. Physical Characteristics:
 - a. Material: Cellular glass per ASTM C552.
 - b. Nominal Density: 7.5 pcf.
3. Functional Characteristics:
 - a. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.
 - b. Follow manufacturer's recommendation, based upon temperature of piping to be insulated.
4. Performance Characteristics:
 - a. Compressive Strength: 90 psi per ASTM C165.
 - b. Temperature Rating: Minus 290 degrees F to 900 degrees F.
 - c. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.29 Btu in./hr square foot degrees F.
 - d. Minimum water vapor transmission for insulation of 0.00 perm-inch per ASTM E96/E96M.
 - e. Flame Spread Rating: 0 per ASTM E84.
 - f. Smoke Developed Index: 0 per ASTM E84.

2.02 ROOF DRAIN AND OVERFLOW DRAIN SUMP INSULATION

- A. Type 1: 1 inch thick.

2.03 INSULATION AT PIPE HANGERS AND SUPPORTS

- A. Physical Characteristics:

1. Copper, Ductile Iron, and Nonmetallic Pipe: High-density insert, thickness equal to adjoining insulation of Type 3 or other rigid insulation or manufactured pre-insulated pipe hanger and insulation shield. Extend insert beyond shield.

2. Steel Pipe: Insulation saddle or high-density insert, thickness equal to adjoining insulation of Type 3 or other rigid insulation or manufactured pre-insulated pipe hanger and insulation shield at support location. Extend insert beyond shield.
- B. Functional Characteristics: None.
- C. Performance Characteristics: Refer to Section 40 05 15, Piping Support Systems.

2.04 INSULATION FINISH SYSTEMS

- A. Type F1—PVC:
1. Manufacturers and Products:
 - a. Johns Manville; Zeston 2000 or 300.
 - b. Or equal.
 2. Physical Characteristics: Polyvinyl chloride (PVC) jacketing, minimum 20 mils indoors and 30 mils outdoors, for straight run piping and fitting locations, temperatures to 140 degrees F.
 3. Functional Characteristics:
 - a. Color Coding: PVC jacketing shall be color coded to match colors listed in Piping Schedule, as shown on the Drawings, where suitable matching colors are available. If no suitable colors are available jacketing shall be white and color bands provided similar to the color bands as specified for exposed stainless steel piping in Section 09 90 00, Painting and Coating.
 4. Performance Characteristics:
 - a. Flame Spread Rating: 25 per ASTM E84.
 - b. Smoke Developed Index: 50 per ASTM E84.
- B. Type F2—Paint:
1. Manufacturers and Products:
 - a. Armacell; WB Armaflex finish.
 - b. Or equal.
 2. Physical Characteristics:
 - a. Type 1 Insulation: Acrylic latex paint and suitable for outdoor use.
 - b. Type 2 Insulation: In accordance with Section 09 90 00, Painting and Coating.
 3. Functional Characteristics:
 - a. Color Coding: Paint finish system shall be color coded to match colors listed in Piping Schedule, as shown on the Drawings, where suitable matching colors are available. If no suitable colors are available jacketing shall be white and color bands provided

similar to the color bands as specified for exposed stainless steel piping in Section 09 90 00, Painting and Coating.

4. Performance Characteristics: None.

C. Type F3—Aluminum:

1. Manufacturers and Products:
 - a. RPR Products; Insul-Mate.
 - b. Or equal.
2. Physical Characteristics:
 - a. Aluminum Roll Jacketing: For straight run piping, wrought aluminum Alloy 3003, 5005, 1100, or 3105 to ASTM B209 with H 14 temper, in accordance with ASTM C1729, minimum 0.016-inch thickness, with smooth mill finish.
3. Functional Characteristics:
 - a. Vapor Barrier: Provide factory applied vapor barrier, heat and pressure bonded to inner surface of aluminum jacketing.
 - b. Fitting Covers: Material as for aluminum roll jacketing, premolded, one or two piece covers, which includes elbows, tee/valves, end caps, mechanical line couplings, and specialty fittings.
 - c. Provide color bands as specified for exposed stainless steel piping in Section 09 90 00, Painting and Coating.
4. Performance Characteristics: See Supplement Service and Insulation Thickness Table following “End of Section.”

D. Type F4—Foamglass Jacketing:

1. Type 3 Insulation—Buried and Up to 1 Foot Above Grade:
 - a. Manufacturers and Products:
 - 1) Pittsburgh Corning; Pittwrap SS.
 - 2) Or equal.
 - b. Physical Characteristics: 70-mil bituminous resin with woven, glass fabric, aluminum foil layer, and plastic film coating, self-sealing manual pressure seals.
 - c. Functional Characteristics: None.
 - d. Performance Characteristics: See Supplement Service and Insulation Thickness Table following “End of Section.”
2. Type 3 Insulation—Greater than 1 Foot Above Grade:
 - a. Manufacturers and Products:
 - 1) Pittsburgh Corning; Pittwrap CW30.
 - 2) Or equal.
 - b. Physical Characteristics: 30-mil modified bituminous membrane with self-sealing manual pressure seals.

- c. Functional Characteristics: None.
- d. Performance Characteristics: See Supplement Service and Insulation Thickness Table following “End of Section.”

PART 3 EXECUTION

3.01 APPLICATION

A. General:

1. Insulate valve bodies, flanges, and pipe couplings.
2. Insulate and vapor seal hangers, supports, anchors, and other piping appurtenances that are secured directly to cold surfaces.
3. Do not insulate flexible pipe couplings and expansion joints.
4. Service and Insulation Thickness: Refer to Supplement Service and Insulation Thickness table following “End of Section” and to Pipe Schedule as shown on the Drawings.

3.02 INSTALLATION

A. General:

1. Install in accordance with manufacturer’s instructions and as specified herein.
2. Install after piping system has been pressure tested and leaks corrected.
3. Install over clean dry surfaces.
4. Use insulating cements, lagging adhesives, and weatherproof mastics recommended by insulation manufacturer.
5. Do not allow insulation to cover nameplates or code inspection stamps.
6. Run insulation or insulation inserts continuously through pipe hangers and supports, wall openings, ceiling openings, and pipe sleeves, unless otherwise shown.
7. Install removable insulation sections on devices that require access for maintenance of equipment or removal, such as unions and strainer end plates.
8. Personnel Protection: Install on pipes from floor to 8 feet high. Install on pipes within 4 feet of side and 8 feet high above platforms, stairs, and access ladders.

B. Connection to Existing Piping: Cut back existing insulation to remove portion damaged by piping revisions. Install new insulation.

C. Cold Surfaces: Provide continuous vapor seal on insulation on cold surfaces where vapor barrier jackets are used.

D. Placement:

1. Insulate valves and fittings with sleeved or cut pieces of same material.
2. Seal and tape joints.

E. Heat Traced Piping: Apply insulation after heat-tracing work is completed and inspected.

F. Roof Drains and Overflow Drains (Interior): Insulate entire pipe runs. Where roof and overflow drains exist through an exterior wall ensure annular space between pipes and walls are properly sealed prior to insulating.

G. Roof Drain and Overflow Drain Sumps: Insulate entire sumps.

H. Vapor Barrier:

1. Provide continuous vapor barrier at joints between rigid insulation and pipe insulation.
2. Install vapor barrier jackets with pipe hangers and supports outside jacket.
3. Do not use staples and screws to secure vapor sealed system components.

I. Aluminum Jacket:

1. Use continuous friction type joint to hold jacket in place, providing positive weatherproof seal over entire length of jacket.
2. Secure circumferential joints with preformed snap straps containing weatherproof sealant.
3. On exterior piping, apply coating over insulation and vapor barrier to prevent damage when aluminum fitting covers are installed.
4. Do not use screws or rivets to fasten fitting covers.
5. Install removable prefabricated aluminum covers on exterior flanges and unions.
6. Caulk and seal exterior joints to make watertight.

3.03 FIELD FINISHING

A. Apply coating of insulating cement where needed to obtain smooth and continuous appearance.

B. Where pipe labels or banding are specified, apply to finished insulation, not to pipe.

C. Painting Piping Insulation (Exposed to View):

1. Aluminum or color coded PVC jacketing does not require painting.
2. If insulated piping system is indicated to be painted in Section 40 27 00, Process Piping—General, piping shall receive the following:
 - a. Prime coat in accordance with Section 09 90 00, Painting and Coating.
 - b. Finished insulation (and not pipe) shall be painted in accordance with Section 09 90 00, Painting and Coating.

3.04 SUPPLEMENT

- A. The supplement listed below, following “End of Section,” is a part of this specification:
1. Service and Insulation Thickness Table.

END OF SECTION

Service and Insulation Thickness								
Service Type	Pipe Legend	Thickness	Fluid Temperature (degrees F)	Insulation	Finish Systems			
					Concealed from View	Indoors Exposed	Outdoors	Buried
Noise attenuation, limit heat rejection to building interior, and personnel exposure.	PA	1.5-inch	>240	Type 2	NA	F1	NA	NA
HT-Piping requiring heat tracing.		Pipe Size: Insulation Thickness Inches:*		Type 2 Insulate and heat trace outside lines 1' above grade. Use Type 3 insulation from 1' above grade to frost depth.	None	NA	F3	F4 on Type 3
Inches*: Based upon insulation with glass fiber per ASTM C547, outdoors with 20 mph wind with 10 percent safety and no value assigned to cladding or air space at cladding. Matches the watts per foot in Section 40 05 33, Pipe Heat Tracing. 2012 IECC requires 1-inch minimum thickness.								

