



PERMATHERM, INC.

SPECIFICATION

FOR

COLD/CRYO PIPE INSULATION

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The specification guideline in the three-part format required by the Construction Specification Institute outlines the PermaTherm pipe insulation and vapor barrier products for use on piping and equipment for process control, condensation control and energy conservation. This guideline covers vapor barriers in the form of thin, flexible film and adhesive tape.

SECTION 15086 (per CSI Format)

MECHANICAL INSULATION

Part 1 GENERAL

1.0 Summary

1.1 This section includes mechanical insulation for process and condensation control as well as energy conservation applications on piping and equipment operating from -310 °F to +167°F, including, but not limited to, refrigerant piping.

2.0 References

- 2.1 ASTM C755 – Standard Practice for Selection of Vapor Retarders for Thermal Insulation
- 2.2 ATSM C1136 – Standard Specification for Flexible, Low-Permeance Vapor Retarders for Thermal Insulation
- 2.3 ASTM E84 – Standard Test Method for Surface-Burning Characteristics of Building Materials
- 2.4 ASTM C578-10a Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
- 2.5 UL 723 – Test for Surface-Burning Characteristics of Building Materials



3.0 SYSTEM DESCRIPTION

3.1 A complete mechanical insulation system consists of insulation, vapor barrier, protective jacket, and associated sealants and tapes, which will maintain process temperatures within requisite boundaries, prevent condensation on the outer surface of the insulation system, and/or provide the desired level of energy conservation.

4.0 SUBMITALLS

4.1 Product Data: The owner/engineer shall confirm and/or identify the required insulation type (and density) as specified in this document as well as the required insulation thickness and other relevant insulation dimensions (pipe or equipment size). The owner/engineer shall also identify additional system components such as vapor-barrier sheeting (factory or field applied), vapor-barrier tape, mastics, sealants, jackets, banding, and pipe hangar-related design.

5.0 QUALITY ASSURANCE

5.1 Fire Test Performance: Each component of the insulation system shall be tested for flame spread and smoke generation via test method ASTM E84. This flame/smoke performance shall meet the requirements of applicable building codes.

5.2 Installer Qualifications: The insulation contractor installing this insulation system must be experienced with similar types of systems and products.

6.0 DELIVERY, STORAGE, AND HANDLING

6.1 Packaging: All insulation materials shall be delivered to project site in original, unbroken factory packaging labeled with product designation and thickness.

6.2 Shipment: Shipment of materials from the manufacturer to the project location shall be in weather-tight transportation.

6.3 Storage: Insulation materials delivered to the jobsite shall be stored so as to protect the materials from moisture and weather during storage and installation. The insulation material shall be protected from long exposure to UV light from the sun.

7.0 PROJECT CONDITIONS:

7.1 All testing of piping systems shall be completed prior to the installation of the insulation system.

7.2 All pipes shall be clean, dry and free of foreign substances prior to the application of the insulation system.

8.0 RESISTANCE TO THE ENVIRONMENT

8.1 GENERAL NOTES



- 8.1.1 The breadth of environmental conditions includes temperature, frequency and degree of temperature cycling, solar intensity, humidity, wind speed, physical abuse, ultraviolet exposure, chemical exposure, wash-down frequency, clean room specifications and maintenance requirements, among others. Thus, it is inappropriate to address each condition in the document; the owner should consult an engineer, and have him work closely with the fabricator, the contractor and PermaTherm to help ensure a properly designed, installed, and long-lasting insulation system.
- 8.1.2 Corrosion of metal pipes, vessels, and equipment under insulation, while not typically caused by the insulation, is still a significant issue that must be considered during the design of any mechanical insulation system. The propensity for corrosion is dependent on many factors including the ambient environment and the operating temperature of the metal.
- 8.1.3 Ultraviolet protection may be required for outdoor installations and should be considered, which may require aluminum or stainless-steel jacketing.
- 8.1.4 Clean room installations and/or areas with frequent wash-down requirements may require special consideration such as solvent welding of PVC jacketing.

PART 2 PRODUCTS

1.0 PIPE INSULATION PRODUCTS FOR SERVICE TEMPERATURE RANGE OF 310°F TO +167°F

1.1 Acceptable Products:

- 1.1.1 PermaTherm 427 (2lb/ft³) rigid expanded polystyrene pipe insulation

1.2 Acceptable Manufactures: PermaTherm, Inc.

- 1.2.1 Contact Information: Refer to heading on the first page of this guideline.

1.3 Substitutions: No substitutions are permitted without credible justification.

1.4 Product Testing:

- 1.4.1 Insulation meets the requirements of ASTM C578 for Type IX.
- 1.4.2 Insulation has an aged thermal conductivity of no more than 0.21 btu-in/hr-ft²-°F measured at 20°F for Type IX EPS.
- 1.4.3 Insulation products shall have a flame spread/smoke generation as required per local code and performance tested via method ASTM E-84 or equivalent.

2.0 VAPOR BARRIERS AND ROOF PENETRATION PRODUCTS

2.1 General



2.1.1 For pipe service temperatures below ambient, a vapor barrier is required. The owner's engineer should be consulted.

2.2 Acceptable Manufacturers

2.2.1 The vapor-barrier sheet shall be PermaTherm's PMZ vapor barrier. The vapor-barrier sheet is formed by laminating a 1-mil thickness of aluminum between two thicknesses of an extraordinarily strong polyester film.

2.2.2 The vapor-barrier tape shall be PermaTherm's PMZ Vapor-Barrier tape (PMZ). The PMZ Vapor-Barrier Tape is a three-ply laminate made with a 1-mil aluminum foil with 0.5 mil polyester film on both sides and coated with a special cold-weather, acrylic pressure-sensitive adhesive system.

2.2.3 The vapor-barrier sealant shall be Boss 368 Butyl Rubber Sealant.

2.2.4 The pipe roof/wall sleeves for penetrations shall be PermaTherm's Permacast Fitting Seal Roof/Wall Sleeves.

2.3 Substitutions: No substitutions are permitted without credible justification.

2.4 Product Properties:

2.4.1 PermaTherm PMZ Vapor-Barrier Sheet

2.4.1.1 Aluminum foil: 1 mil

2.4.1.2 Film: 1 mil

2.4.1.3 Adhesive: flame retardant

2.4.1.4 Permeance (MTVR) per ASTM E-96: 0000 perms

2.4.1.5 Service Temp. Range: -100 °F to +300°F

2.4.1.6 Tensile Strength: 20,000 psi

2.4.1.7 Bursting Strength: 95 psi

2.4.1.8 UL File Number: R20722

2.4.1.9 Flame Spread (Aluminum) per ASTM E-84 & UL 723: 10FSI

2.4.1.10 Smoke Generation (Aluminum) per ASTM E-84 & UL 723: 25 SDI

2.4.1.11 Flame Spread (White) per ASTM E-84 & UL 723: 10 FSI

2.4.1.12 Smoke Generation (White) per ASTM E-84 & UL 723: 25 SDI

2.4.2 PermaTherm's PMZ Vapor-Barrier Tape

2.4.2.1 Adhesive Thickness: 1.5 mils (0.0015") 0.0381 mm

2.4.2.2 Substrate Thickness: 2.5 mils (0.0025") 0.0630

2.4.2.3 Adhesion: Peel (PSTC-1) 60 oz/inch width 17 N/2.5cm

2.4.2.4 Shear: (PSTC-7) Indefinite @ 2.2psi 15.2 kPa

2.4.2.5 Tensile: (PSTC-31) 15 lbs./inch width 68N/2.5cm

2.4.2.6 Elongation: 50% 50%

2.4.2.7 Maximum Continuous Use Temperature: 300 °F

2.4.2.8 Glass Transition Temperature (T₂): -40 °F (40°C)

- 2.4.2.9 Release Liner: 55 lb. 90 GSM
- 2.4.3 PermaCast Fitting Seal (Factory Applied)
 - 2.4.3.1 Water Vapor Transmission: E-96.02
 - 2.4.3.2 Tensile Strength (psi): 1,900
 - 2.4.3.3 Elongation (%): 31
 - 2.4.3.4 Flexural Modulus (psi): 81,864 (@-20 °F); 58,736 (@72°F); 4,475 (@158°F)
 - 2.4.3.5 Tear Strength: Graves (pli) 223
 - 2.4.3.6 Notched Izod Impact (ft. -lbs./in.): 1.23
 - 2.4.3.7 Coef. Lin. Thermal Exp (x10 (-6)): 113
 - 2.4.3.8 Heat Distortion (°F @66 psi): 160
 - 2.4.3.9 Hardness (Short 'D"): 67
 - 2.4.3.10 Density (lb./ft³): 50
 - 2.4.3.11 Taber Wt. Loss, mg Loss: 518 [1000 cycles, 18 wheels]
 - 2.4.3.12 NBS Abrasion: cycle 200
 - 2.4.3.13 NBS inches abraded to .1 inch
- 2.4.4 Boss 368 Butyl Rubber Sealant
 - 2.4.4.1 Specific Gravity: 1.62 g/cc
 - 2.4.4.2 Weight per gallon: 12-15 lbs.
 - 2.4.4.3 Shrinkage: 10% Max.
 - 2.4.4.4 Flexibility: No cracking, separation or loss of adhesion of a 3/8" – diameter bead on galvanized steel when bent at -60°F over ¼" mandrel after being subjected to three cycles of 16 hours at 158°F; 8 hours at 0 °F, and after first conditioning for 2 days at 77°F.
 - 2.4.4.5 Slump: ASTM-D-2202 0.5" at 158°F
- 2.5 Allowable Installation Temperatures
 - 2.5.1 PMZ Vapor-Barrier Sheeting can be installed in virtually any ambient environmental conditions down to -40°F. For maximum film flexibility, the product should be installed at ambient temperatures above 24°F.
 - 2.5.2 PMZ Vapor-Barrier Tape can be installed in virtually any ambient environmental conditions down to -40°F. For maximum film flexibility and adhesion, the product should be installed at ambient temperatures above 24°F.
 - 2.5.3 Recommended installation temperatures for 907 Butyl Rubber Sealant area between 40°F and 150°F.
 - 2.5.4 PermaCast sleeves can be installed in virtually any ambient environmental conditions.

3.0 PROTECTIVE JACKETING



- 3.1 See Part I (8) above regarding environmental conditions.
- 3.2 As further elaborated above, the requirement or appropriateness of a jacket may depend on a number of factors. Here are the following instances:
 - 3.2.1 The potential for physical or mechanical abuse (i.e.) stepping on the pipe) may override other considerations.
 - 3.2.2 The addition of even a moderately effective vapor retarder such as an ASJ jacket may provide a cost-effective “second line of defense.”
 - 3.2.3 Composite metal jackets with factory-installed vapor barrier liners may be so cost-effective that they become a logical choice to ensure long-term performance.
- 3.3 Corrosion of metal pipe, vessels, and equipment under insulation, while not typically caused by the insulation, is still a significant issue that must be considered during the design of any mechanical insulation system. The propensity for corrosion is dependent on many factors including the ambient environment and the operating temperature of the metal.
- 3.4 Ultraviolet protection may be required for outdoor installations and should be taken into account. This may require aluminum or stainless-steel jacketing.
- 3.5 Clean room installations and/or areas with frequent wash-down requirements may require special consideration such as solvent welding of PVC jacketing.

PART 3 EXECUTION

1.0 MANUFACTURER’S INSTALLATION INSTRUCTIONS

- 1.1 Comply with manufacturer’s installation guidelines for each insulation system component.

2.0 EXAMINATION

- 2.1 Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- 2.2 Proceed with the installation only after any unsatisfactory conditions have been corrected.

3.0 PREPARATION

- 3.1 Prepare the mechanical system in accordance with Part I sections 7 and 8 of this specification.

4.0 INSTALLATION

- 4.1 All insulation shall be tightly butted and free of voids and gaps. Vapor barriers must be continuous. All fasteners and bands shall be neatly aligned, and overall work must be of high quality in appearance and workmanship.



- 4.2 In below ambient systems, staples, rivets, screws and other fasteners capable of penetrating the vapor barriers shall not be used.
- 4.3 Install prefabricated insulation fittings on elbows, tees, and valves. Insulation at fittings shall be of the same type and thickness as on straight pipe selections.
- 4.4 The lap joint of vapor barrier has to be sealed using a self-sealing tape or a liquid adhesive. The vapor-barrier butt joints shall be covered with the PermaTherm PMZ vapor-barrier tape.
- 4.5 When it is not feasible to wrap elbows and fittings with PMZ vapor-barrier tape sheeting, they shall be wrapped with PMZ vapor-barrier tape in a spiral, overlapping fashion.

5.0 UNDERGROUND INSTALLATIONS

- 5.1 Trench is to be constructed with stone bedding. It should be sand backfilled as well.
- 5.2 PermaTherm EPS rigid foam insulation should be wrapped with a tough, puncture-resistant vapor barrier and covered in appropriate jacketing.
- 5.3 Promulgate design data for input from manufacturers.