



This guideline specifies polyisocyanurate pipe insulation and plastic vapor retarder products for use on piping and equipment for condensation control and energy conservation. This guideline is for insulation in the form of rigid half-shell pieces for piping and rigid sheets for equipment. This guideline is also for vapor retarder in the form of a thin flexible film and adhesive tape.

## SECTION 15086 MECHANICAL INSULATION

### Part 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Mechanical insulation for condensation control and energy conservation applications on piping and equipment operating from -30°F to 300°F, including but not limited to, chilled water piping.
- B. Related Sections
  - 1. Pipe Hangers: Division 15, Section 60, Hangers & Supports
  - 2. Equipment Insulation: Division 15, Section 83, Equipment Insulation
  - 3. Vapor Retarders: Division 7, Section 260, Vapor Retarders

#### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM C591 – Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
  - 2. ASTM C755 – Standard Practice for Selection of Vapor Retarders for Thermal Insulation
  - 3. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
  - 4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
  - 5. ASTM C920 – Standard Specification for Elastomeric Joint Sealants
  - 6. ASTM C921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
  - 7. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials
- B. National Fire Protection Association (NFPA):
  - 1. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials
  - 2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems
- C. Underwriters Laboratories (UL):
  - 1. UL 723 – Test for Surface Burning Characteristics of Building Materials

#### 1.03 SYSTEM DESCRIPTION

- A. A complete mechanical insulation system consisting of insulation, vapor retarder, an optional protective jacket, and associated sealants and tapes which will prevent condensation on the outer surface of the insulation system or provide the desired level of energy conservation.

#### 1.04 SUBMITTALS

- A. Product Data: Identify required insulation thickness and other relevant insulation dimensions (pipe or equipment size). Identify required vapor retarder type and whether vapor retarder will be factory or field applied. Identify protective jacketing type and thickness (if required).

## 1.05 QUALITY ASSURANCE

- A. Fire Test Performance: Each component of the insulation system shall be tested for flame spread and smoke generation via test method ASTM E84, UL 723, or NFPA 255. This flame/smoke performance shall meet the requirements of applicable building codes.
- B. Installer Qualifications: Insulation contractor installing this insulation system must be experienced with similar type systems and products.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: All insulation material shall be delivered to project site in original, unbroken factory packaging labeled with product designation and thickness.
- B. Shipment: Shipment of materials from the manufacturer to the project location shall be in weathertight transportation. Insulation packages and containers shall be asbestos free.
- C. Storage: Insulation materials delivered to the jobsite shall be stored so as to protect the materials from moisture and weather during storage and installation. Insulation material shall be protected from long exposure to UV light from the sun.

## 1.07 PROJECT CONDITIONS:

- A. All testing of piping systems shall be completed prior to the installation of the insulation system.
- B. All pipe shall be clean, dry, and free of foreign substances prior to application of the insulation system.

## Part 2 PRODUCTS

### 2.01 PIPE INSULATION FOR SERVICE TEMPERATURE RANGE OF -30°F TO +300°F

- A. Manufacturers:
  - a) Hitherm N.A.
  - b) Duna
  - c) ITW
- B. Products: Nominal 2lb/ft<sup>3</sup> rigid polyisocyanurate Insulation fabricated to shape from bun stock.
  - a. Rigid Polyisocyanurate Insulation--similar to PIR365 manufactured by HiTherm N.A.
- C. Product Testing:
  - a. Product has a thermal Conductivity of 0.168 btu-in/hr-ft<sup>2</sup>-°F or lower at 75°F.
  - b. Product shall have a flame spread/smoke generation performance tested via method ASTM E-84, UL 723, or NFPA 255 of 25/50 or better for **all thicknesses specified**.
  - c. Vapor Retarder For Service Temperature Range of +35°F to +60°F
- D. For pipe service temperatures below ambient and for cycling HVAC systems, a vapor retarder is required. For pipe service temperatures above ambient (60°F), a vapor retarder shall not be used and a protective jacketing shall be used.
- E. Vapor retarder shall be any **non-paper** faced vapor retarder
  - I. Manufacturers:
    - a. Compac
    - b. Polyguard
  - II. Product Testing:
    - a. Vapor Retarder Film
      - 1) Film Thickness: Greater than 3plys standard grade
      - 2) Water vapor permeance: 0.01 perms when tested in accordance with ASTM E96/E 96M
      - 3) Color: White, silver or natural

## 2.02 PROTECTIVE MECHANICAL JACKETING

- A. Protective Mechanical Jacketing is optional on indoor below ambient services and shall be required in indoor, above ambient services. Protective Jacketing is required in all outdoor installations.
  - 1. Indoor Applications: Protective jacketing, if used, shall be 0.010 to 0.030 inch thick PVC.
    - a. Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance.
  - 2. Outdoor Applications: Jacketing shall be RPR or SMI Insulation Systems' metal cladding made from aluminum alloys 3033, 110 or 3105 meeting ASTM B-209 with H-14 temper, 0.016" thick polysurlyn on the inner side. Consult manufacturer for appropriate recommendations.
    - a. Aluminum Jacket securing bands shall be Type 304 stainless steel. Bands shall be 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch in diameter.

## 2.03 ADHESIVES

- A. Contact Adhesives
  - 1. Adhesive may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and maximum smoke index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, nor shall it cause any corrosive effect on metal to which it is applied.

## 2.04 MASTIC AND COATINGS

- A. Vapor Barrier Mastic
  - 1. The coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. The water vapor permeance shall be determined according to procedure B of ASTM E96/E 96M. The coating shall not adversely affect the insulation to which it is applied. Consult manufacturer for appropriate recommendations.

# Part 3 EXECUTION

## 3.01 MANUFACTURER'S INSTALLATION INSTRUCTIONS

- A. Comply with manufacturer's installation guidelines.

## 3.02 EXAMINATION

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

## 3.03 PREPARATION

- A. Prepare mechanical system in accordance with sections 1.07 and 1.08 of this guideline.

## 3.04 PIPE INSULATION SYSTEMS

- A. Aboveground Cold Pipeline (-30 to +60 deg. F)
  - 1. Polyisocyanurate Insulation: ASTM C591, Type 1. Supply the insulation with the Manufacturer's recommended factory-applied vapor barrier/vapor retarder.
- B. Aboveground Hot Pipeline (above +60 deg. F)
  - 1. Polyisocyanurate Insulation: ASTM C591, Type 1. Supply the insulation with the Manufacturer's recommended factory-applied jacket/vapor barrier.

## 3.05 INSTALLATION

- A. Except as otherwise specified, material shall be installed in accordance with manufacturer's installation guidelines.
- B. In below ambient systems, staples, rivets, screws and other fasteners capable of penetrating the vapor retarder shall not be used.

- C. **Install pre-fabricated insulation fittings on elbows, tees, and valves. Insulation at fittings shall be the same type and thickness as on straight pipe sections.**
- D. Insulation sections in hanger saddles shall be 2lb/ cu ft polyisocyanurate for pipes less than 16 NPS. At 10 feet hanger spacing and on pipes 16 NPS and larger, the bottom insulation sections in hanger saddles shall be 3lb/cu ft **rigid polyisocyanurate foam insulation** for resistance to compression . Saddles shall wrap the insulation in an arc between 120° and 180° depending upon the load.
- G. **When vapor retarder film and tape are used, and when the pipe size is 4" in diameter or greater, a 1"-wide or greater filament tape with a 25% (1-1/4 wraps) circumferential overlap is recommended to be wrapped around the outside of the vapor retarder on 18" centers.**

### 3.06 UNDERGROUND INSTALLATION

- A. Trench to be constructed with stone bedding. Trench to be sand backfilled.
- B. Rigid polyisocyanurate foam insulation to be wrapped with a tough puncture resistant vapor retarder jacketing. No outer mechanical jacketing is required.
- C. Acceptable Vapor Retarders
  - 1. Rubberized bituminous membrane material with a minimum 50 mils thickness.
    - a. Submit manufacturer's data for approval.

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NOTE: In chilled water applications, the insulation thickness required for **condensation control is critical**. This will vary with the geography and climatic conditions. For polyisocyanurate Insulation, typically for an outdoor installation with ambient temperature of 90°F and 90% Relative Humidity a thickness of 2.0" is advised. Similarly, for an indoor, conditioned air installation with ambient temperature of 75°F and 70% Relative Humidity a thickness of 1.0 or 1.5" of polyiso is advised. These values are provided for typical commercial applications.