

## SECTION 22 07 19.00 40

## PIPING INSULATION

07/07

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM B 209	(2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1136	(2006) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 195	(2000) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(2007) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(2007a) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2007) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C 552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C 795	(2003) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(2003a) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM E 84	(2007b) Standard Test Method for Surface

Burning Characteristics of Building  
Materials

ASTM E 96/E 96M

(2005) Standard Test Methods for Water  
Vapor Transmission of Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220

(2006) Standard on Types of Building  
Construction

## 1.2 PERFORMANCE REQUIREMENTS

Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, shall have a flame-spread classification (FSC) of 25, and a smoke-developed classification (SDC) of 50. These maximum values shall be determined in accordance with ASTM E 84. Coatings and sealants shall be nonflammable in their wet state.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Installation Drawings for pipe insulation shall be submitted in accordance with paragraph entitled, "Installation," of this section.

## SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Adhesives  
Coatings  
Insulating Cement  
Insulation Materials  
Jacketing

## PART 2 PRODUCTS

## 2.1 MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following.

### 2.1.1 Adhesives

#### 2.1.1.1 Cloth Adhesives

Adhesives for adhering, sizing, and finishing lagging cloth, canvas, and open-weave glass cloth shall be a pigmented polyvinyl acetate emulsion and shall conform to the requirements of [ASTM C 916](#), Type I.

#### 2.1.1.2 Vapor-Barrier Material Adhesives

Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be solvent-base, synthetic-rubber type and shall conform to the requirements of [ASTM C 916](#), Type I, for attaching fibrous-glass insulation to metal surfaces. Solvent shall be nonflammable.

#### 2.1.1.3 Cellular Elastomer Insulation Adhesive

Adhesive for cellular elastomer insulation shall be a solvent cutback chloroprene elastomer conforming to [ASTM C 916](#), Type I, and shall be of a type approved by the manufacturer of the cellular elastomer for the intended use.

### 2.1.2 Coatings

#### 2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be a nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to the requirements of [ASTM C 1136](#) and [ASTM C 921](#).

#### 2.1.2.2 Indoor Vapor-Barrier Finishing

Coatings for indoor vapor-barrier finishing of insulation surfaces shall be a pigmented resin and solvent compound and shall conform to [ASTM C 1136](#), Type II.

#### 2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer-emulsion type recommended by the insulation material manufacturer for the surface to be coated and shall be applied to specified dry-film thickness.

#### 2.1.2.4 Cellular-Elastomer Insulation Coating

Finish coating for cellular-elastomer insulation shall be a polyvinylchloride lacquer approved by the manufacturer of the cellular elastomer.

#### 2.1.2.5 Coating Color

Coating color shall be white blend with background of surrounding area

### 2.1.3 Insulating Cement

#### 2.1.3.1 General Purpose Insulating Cement

General purpose insulating cement shall be mineral fiber and shall conform to [ASTM C 195](#). Composite shall be rated for [1800 degrees F](#) service and shall have a thermal-conductivity maximum of [0.85 Btu by inch per hour per square foot for each degree F](#) temperature differential at [200 degrees F](#) mean temperature for [1 inch](#) thickness.

#### 2.1.3.2 Finishing Insulating Cement

Finishing insulating cement shall be mineral-fiber, hydraulic-setting type conforming to [ASTM C 449/C 449M](#).

#### 2.1.4 Calking

Calking used with specified insulation materials shall be an elastomeric joint sealant in accordance with [ASTM C 920](#), Type S, Grade NS, Class 25, Use A.

#### 2.1.5 Corner Angles

Corner angle piping insulation shall be nominal [0.016 inch](#) aluminum [1 by 1 inch](#) with factory applied kraft backing. Aluminum shall be in accordance with [ASTM B 209](#), Alloy 3003.

### 2.1.6 Insulation Materials

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

#### 2.1.6.1 Mineral Fiber

Mineral fiber shall conform to [ASTM C 547](#), shall be suitable for surface temperatures up to [370 degrees F](#), and shall be of not less than [4-pound per cubic foot](#) density. Thermal conductivity shall be not greater than [0.26 Btu per hour per square foot square per degree F](#) at [150 degrees F](#) mean.

#### 2.1.6.2 Pipe Barrel

Pipe barrel insulation shall be Type II, Molded, Grade A or Type III, Precision V-Groove, Grade A for use at temperatures up to and including [1200 degrees F](#).

#### 2.1.6.3 Pipe Fittings

Pipe fitting insulation shall be molded pipe fitting covering for use at temperatures up to and including [1200 degrees F](#).

#### 2.1.6.4 Flexible Blankets

Flexible blankets shall be blankets and felts for use at temperatures up to and including [350 degrees F](#) minimum [1 pound per cubic foot](#) density. Thermal conductivity shall be not greater than [0.26 Btu per hour per square](#)

foot per degree F at 75 degrees F mean.

#### 2.1.6.5 Cellular Elastomer

Cellular elastomer shall conform to ASTM C 534, except that the water-vapor permeability shall not exceed 0.30 perms per foot per inch per hour per square foot mercury pressure difference for 1 inch thickness.

#### 2.1.6.6 Cellular Glass

Cellular glass shall conform to ASTM C 552, Type II, Grade 2, pipe covering. Substitutions for this material shall not be permitted. Minimum thickness shall be 1-1/2 inches

#### 2.1.6.7 Calcium Silicate

Calcium silicate shall conform to ASTM C 533. Apparent thermal conductivity shall be not greater than 0.54 Btu-inch per hour per square foot per degree F at 200 degrees F mean.

### 2.1.7 Jacketing

#### 2.1.7.1 Stainless Steel Jackets

Stainless steel sheet shall be 0.016 inch thick with factory-applied vapor barrier on the insulation side.

Elbow jackets shall be 0.016 inch thick, deep-drawn, die-shaped, two-piece components for long-radius, butt-weld elbows manufactured from the same materials as specified for jackets, with factory-attached vapor-seals on underside. Preinsulated, voidless, jacketed components conforming to these specifications shall be used. Preinsulated fittings shall have a 2 inch overlay beyond route for weld bead.

Vapor barrier shall be 30-60-30 laminated-asphalt paper with 10 pound per 100 square foot polyethylene coating.

Pipe jackets shall have not less than 2 inch longitudinal and circumferential lap.

Sealant for longitudinal and butt joints of stainless steel jacketing shall be an aluminum-pigmented, butyl, polymer sealant with high-butyl solids.

#### 2.1.7.2 PVC Jackets

Polyvinylchloride (PVC) shall be a 0.010 inch thick, factory-premolded, one-piece fitting. Material shall be self-extinguishing, high-impact strength, moderate chemical resistance. Permeability rating shall be 0.01 grain per hour per square foot per inch of mercury pressure difference, determined in accordance with ASTM E 96/E 96M. Vapor-barrier joint adhesive shall be the manufacturer's standard solvent-weld type.

Vapor barrier shall conform to ASTM C 1136, Type I, low-vapor transmission, high-puncture resistance for use on insulation for piping, ducts, and equipment.

## 2.2 PIPING SYSTEMS

Insulation thickness and pipe sizes are in inches. Pipe size is inclusive

dimensionally, and includes pipe nominal pipe size (NPS) and tubing outside diameter.

### 2.2.1 Hot-Water Chemical Piping

Insulation shall be mineral fiber with glass cloth jacket, Type T-2. Thickness shall be not less than that given in the following list. Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

<u>PIPE SIZE</u> <u>(INCH)</u>	<u>INSULATION THICKNESS</u> <u>(INCH)</u>
Up to 4	1
4 to 10	1-1/2

### 2.2.2 Cold-Water and Condensate-Drain Piping

Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

Insulation shall be cellular-elastomer conforming to [ASTM C 534](#). Water-vapor permeability shall not exceed 0.1 grain per square foot per hour per inch mercury pressure-differential for 1 inch thickness.

### 2.2.3 Refrigerant Suction Piping

Insulation shall be cellular-elastomer, Type T-3. Thickness shall be nominal  $3/4$  inch. Surfaces, including valve, fittings, unions, and flanges, shall be insulated.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Joints shall be tight with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed, or finished as specified. Longitudinal seams of exposed insulation shall be directed away from normal view.

Materials shall be applied in conformance with the recommendations of the manufacturer.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

[Installation Drawings](#) for pipe insulation shall be in accordance with the

adhesive manufacturer's written instructions for installation.

### 3.2 SYSTEM TYPES

#### 3.2.1 Type T-2, Mineral Fiber with Glass Cloth Jacket

Cover piping with a mineral-fiber, pipe insulation with factory-attached pre-sized, white, glass cloth. Securely cement jackets, jacket laps, flaps, and bands in place with vapor-barrier adhesive with jacket overlap not less than 1-1/2 inches and jacketing bands for butt joints 3 inches wide.

Cover expose-to-view fittings with preformed mineral-fiber fitting insulation of the same thickness as the pipe insulation and temporarily secured in place with light cord ties. Install impregnated glass lagging tape with indoor vapor-barrier on 50 percent overall basis and the blend tape smoothly into the adjacent jacketing. Apply additional coating as needed, and rubber gloved to a smooth contour. Tape ends of insulation to the pipe at valves 2 inches and smaller. Build up on-the-job fabricated insulation for concealed fittings and special configurations from mineral fiber and a mixture of insulating cement and lagging adhesive, diluted with 3 parts water. Finish surfaces with glass cloth or tape lagging.

Cover all valves 2-1/2 inches and larger and all flanges with preformed insulation of the same thickness as the adjacent insulation. Finish exposed-to-view insulation with a minimum 6-mil dry-film thickness of non-vapor-barrier coating suitable for painting.

#### 3.2.2 Type T-3, Cellular Elastomer

Piping-system surfaces shall be covered with flexible cellular-elastomer sheet or preformed insulation. Vapor seal shall be maintained. Insulation shall be cemented into continuous material with a solvent cutback chloroprene adhesive recommended by the manufacturer for the specific purpose. Adhesive shall be applied to both of the surfaces on a 100-percent coverage basis to a minimum thickness of 10 mils wet or approximately 150 square feet per gallon of undiluted adhesive.

Insulation on cold water piping shall be sealed to the pipe for a minimum of 6 inches at maximum intervals of 12 feet to form an effective vapor barrier. At piping supports, insulation shall be continuous through using outside-carrying type clevis hangers with insulation shield. Cork load-bearing inserts shall be installed between the pipe and insulation shields to prevent insulation compression.

Hot-water, cold-water, and condensate drain pipes shall be insulated to the extent shown with nominal 1/2 inch thick, fire retardant (FR), cellular elastomer, preformed pipe insulation. Joints shall be sealed with adhesive.

At pipe hangers or supports where the insulation rests on the pipe hanger strap, the insulation shall be cut with a brass cork borer and a No. 3 superior grade cork inserted. Seams shall be sealed with approved adhesive. Sweat fitting shall be insulated with miter-cut pieces of cellular elastomer insulation of the same nominal pipe size and thickness as the insulation on the adjacent piping or tubing. Miter-cut pieces shall be joined with approved adhesive. Covers shall be slit and snapped over the fitting, and joints shall be sealed with approved adhesive.

Screwed fittings shall be insulated with sleeve-type covers formed from miter-cut pieces of cellular elastomer thermal insulation having an inside diameter large enough to overlap adjacent pipe insulation. Pipe insulation

shall be butted against fittings. Overlap shall be not less than 1 inch . Adhesive shall be used to join cover pieces and cement the cover to the pipe insulation.

Surfaces exposed to view or ultraviolet light shall be finished with a 2-mil minimum dry-film thickness application of a polyvinylchloride lacquer recommended by the manufacturer, and applied in not less than two coats.

### 3.3 ACCEPTANCE

Final acceptance will depend upon providing construction (Record Drawings) details to the Contracting Officer. Construction details shall include, by building area, the insulation material type, amount, and installation method. An illustration or map of the duct routing locations may serve this purpose. Data shall have a cover letter/sheet clearly marked with the system name, date, and the words "Record Drawings insulation/material." Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --