SECTION 404213 - PROCESS PIPING INSULATION

Note that this section has only been edited for NYSOGS standardization and has not been technically edited. The designer shall make all technical edits specific to the project for this section.

This Section includes insulation applied to process piping systems.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Process piping insulation.

Jacketing.

Accessories.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

* + - * 1. ASTM International:

ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.

ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.

ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

* + - * 1. Manufacturers Standardization Society of the Valve and Fittings Industry:

MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

* + - 1. PREINSTALLATION MEETINGS
				1. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> [**week**] [**weeks**] prior to commencing Work of this Section.
			2. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: Submit product description, thermal characteristics, list of materials, and thickness for each service and location.

Include following Paragraph for submission of physical samples for selection of finish, color, texture, and other properties.

* + - * 1. Samples: Submit [**two**] <**\_\_\_\_\_\_\_\_**> samples of representative size, illustrating each insulation type.
				2. Manufacturer's Certificate: Certify that [**products**] <**\_\_\_\_\_\_\_\_**> meet or exceed [**specified requirements**] <**\_\_\_\_\_\_\_\_**>.

Include separate Paragraphs for additional certifications.

* + - * 1. Manufacturer's Instructions: Submit manufacturer's published literature indicating recommended installation procedures.
				2. Qualifications Statements:

Coordinate following Subparagraphs with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer and applicator.

Submit manufacturer's approval of applicator.

* + - 1. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

Consider specifying a smoke-developed index of 50 within plenums.

Verify flame-spread index and smoke-developed index with types of insulation as specified in this Section. Caution: Some insulation types included in this Section are not allowed to be used in plenums.

* + - * 1. Test pipe insulation for maximum flame-spread index of 25 and maximum smoke-developed index not exceeding [**50**] [**450**], according to ASTM E84.
				2. Comply with ASTM C585 for inner and outer diameters of pipe insulation.
				3. Factory-fabricated fitting covers according to ASTM C450.

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <**\_\_\_\_\_\_\_\_**> standards.

Include following Paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting the Work of this Section on-Site.
			1. QUALIFICATIONS

Coordinate following Paragraphs with the requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
				2. Applicator: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
			1. DELIVERY, STORAGE, AND HANDLING
				1. Accept materials on-Site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
				2. Inspection: Accept insulation on-Site in manufacturer's packaging. Inspect for damage.
				3. Store insulation according to manufacturer's instructions.
				4. Protect insulation from weather and construction traffic, dirt, water, chemicals, and damage by storing in original wrapping.
			2. AMBIENT CONDITIONS
				1. Install insulation only when ambient temperature and humidity conditions are within ranges as recommended by manufacturer.
				2. Maintain recommended temperature and humidity before, during, and after installation for minimum of [**24**] <**\_\_\_\_\_\_\_\_**> hours.
			3. EXISTING CONDITIONS
				1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. WARRANTY

This Article extends warranty period beyond one year. Extended warranties may increase construction costs and State enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish [**five**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for human-made fiber.
1. PRODUCTS
	* + 1. MANUFACTURERS
				1. Glass Fiber and Mineral Fiber Insulation:

[Manufacturers](http://www.specagent.com/LookUp/?ulid=10945&mf=04&src=wd):

designer to provide two manufacturers and approved equivalent for all listed products.

* + - * 1. Closed-Cell Elastomeric Insulation:

[Manufacturers](http://www.specagent.com/LookUp/?ulid=10946&mf=04&src=wd):

designer to provide two manufacturers and approved equivalent for all listed products.

* + - * 1. Polyisocyanurate Foam Insulation:

[Manufacturers](http://www.specagent.com/LookUp/?ulid=10947&mf=04&src=wd):

designer to provide two manufacturers and approved equivalent for all listed products.

* + - * 1. Extruded Polystyrene Insulation:

[Manufacturers](http://www.specagent.com/LookUp/?ulid=10948&mf=04&src=wd):

designer to provide two manufacturers and approved equivalent for all listed products.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - 1. PIPE INSULATION

Generally, pipe insulation is specified with factory-provided vapor barrier jacket. When another type of jacket or finish is desired, delete factory jacket, or choose insulation without jacket and then specify insulation with jacket and finish from choices included in PIPE INSULATION JACKETS Article.

* + - * 1. Type P-1:

Description: Molded glass fiber.

Comply with ASTM C547. [**Comply with ASTM C795 for application on austenitic stainless steel.**]

Thermal Conductivity: 0.23 Btu-in./h-ft.-deg. F at 75 degrees F

Operating Temperature Range: Zero to 850 degrees F

Vapor Barrier Jacket:

Description: Factory-applied, reinforced foil kraft with self-sealing adhesive joints.

Comply with ASTM C1136, Type I.

Jacket Temperature Limits: Minus 20 to 150 degrees F

If multiple layers of glass-fiber pipe insulation are required, inner layer should be following type without vapor barrier jacket. Also consider specifying multiple layers with staggered joints to reduce heat loss.

* + - * 1. Type P-2:

Description: Molded glass fiber.

Comply with ASTM C547. [**Comply with ASTM C795 for application on austenitic stainless steel.**]

Thermal Conductivity: 0.23 Btu-in./h-ft.-deg. F at 75 degrees F

Operating Temperature Range: Zero to 850 degrees F

Consider following insulation for nominal pipe sizes of 10 inches (250 mm) and larger.

* + - * 1. Type P-3:

Description:

Semi-rigid, fibrous glass board.

Noncombustible.

End grain adhered to jacket.

Comply with ASTM C612. [**Comply with ASTM C795 for application on austenitic stainless steel.**]

Thermal Conductivity: 0.27 Btu-in./h-ft.-deg. F at 75 degrees F

Operating Temperature Range: Zero to 650 degrees F

Vapor Barrier Jacket:

Description: Factory-applied, reinforced foil kraft with self-sealing adhesive joints.

Comply with ASTM C1136, Type I.

Jacket Temperature Limits: Minus 20 to 150 degrees F

* + - * 1. Type P-4:

Description:

Semi-rigid, fibrous glass board.

Noncombustible.

Comply with ASTM C612. [**Conform to ASTM C795 for application on austenitic stainless steel.**]

Thermal Conductivity: 0.27 Btu-in./h-ft.-deg. F at 75 degrees F

Operating Temperature Range: Zero to 650 degrees F

* + - * 1. Type P-5:

Description:

Flexible, closed-cell elastomeric.

Tubular.

Comply with ASTM C534, Type I.

Thermal Conductivity: 0.27 Btu-in./h.-ft.-deg. F at 75 degrees F

Operating Temperature Range: Minus 70 to 180 degrees F

* + - * 1. Type P-6:

Description:

Flexible, closed-cell elastomeric.

Tubular.

Comply with ASTM C534, Type I.

Thermal Conductivity: 0.30 Btu-in./h-ft.-deg. F at 75 degrees F

Maximum Service Temperature: 300 degrees F

Operating Temperature Range: Minus 58 to 300 degrees F

* + - * 1. Type P-7:

Description:

Flexible, nonhalogen, closed-cell elastomeric.

Tubular.

Comply with ASTM C534, Type I.

Thermal Conductivity: 0.27 Btu-in./h-ft.-deg. F at 75 degrees F

Maximum Service Temperature: 250 degrees F

Operating Temperature Range: Minus 58 to 250 degrees F.

Consider following type of insulation for high-temperature applications in lieu of calcium silicate. Specify it with bands for attaching to pipe and with a field-applied canvas jacket. Also, consider specifying multiple layers with staggered joints to reduce heat loss.

For cold-temperature applications, consider specifying vapor barrier.

* + - * 1. Type P-8:

Description:

Preformed mineral fiber.

Noncombustible.

Comply with ASTM C547, Type I or II.

Thermal Conductivity: 0.23 Btu-in./h-ft.-deg. F at 75 degrees F.

Maximum Service Temperature: 1,200 degrees F

Canvas Jacket:

Description: Plain-weave cotton fabric treated with fire-retardant lagging adhesive.

UL listed.

Weight: 6 oz./sq. yd

* + - * 1. Type P-9:

Description: Polyisocyanurate foam insulation, formed into shapes for use as pipe insulation.

Comply with ASTM C591, Type IV.

Density: [**2**] [**4**] [**6**] <**\_\_\_\_\_\_\_\_**> pcf

Thermal Conductivity: 180-day aged value of [**0.19**] [**0.19**] [**0.20**] Btu-in./h-ft.-deg. F at 75 degrees F.

Operating Temperature Range: Minus 297 to 300 degrees F.

Vapor Barrier Jacket:

Comply with ASTM C1136, Type I.

Factory-Applied Film Thickness: [**4**] [**6**] mils

Water Vapor Permeance: [**0.02**] [**0.01**] perms.

* + - * 1. Type P-10:

Description: Extruded polystyrene insulation, formed into shapes for use as pipe insulation.

Comply with ASTM C578, Type XIII.

Thermal Conductivity: 180-day aged value of 0.259 Btu-in./h-ft.-deg. F at 75 degrees F.

Operating Temperature Range: Minus 297 to 165 degrees F.

Vapor Barrier Jacket:

Comply with ASTM C1136, Type I.

Factory-Applied Film Thickness: [**4**] [**6**] mils .

Water Vapor Permeance: [**0.02**] [**0.01**] perms.

Following insulation type is usually finished by fastening with tie wire and covering with thermal insulating and finishing cement.

* + - * 1. Type P-11:

Description:

Hydrous calcium silicate.

Rigid molded.

Color: White.

Asbestos free.

Comply with ASTM C533, Type I.

Thermal Conductivity: 0.45 Btu-in./h-ft.-deg. F at 200 degrees F.

Operating Temperature Range: 140 to 1,200 degrees F.

* + - 1. PIPE INSULATION JACKETS

Consider using following Paragraph if insulation does not have factory-furnished vapor barrier jacket.

* + - * 1. Vapor-Retarder Jacket:

Description: White kraft paper with glass-fiber yarn, bonded to aluminized film.

[**Comply with ASTM C921.**]

Water Vapor Permeance:

ASTM E96

0.02 perms

Consider following Paragraph for covering fittings or to cover complete piping system.

* + - * 1. PVC Plastic Pipe Jacket:

Description:

One-piece, molded-type fitting covers and sheet material.

Color: Off-white.

[**ASTM D1785.**]

Thickness: [**10**] [**15**] [**30**] mils.

Connections: [**Brush-on welding adhesive**] [**Tacks**] [**Pressure-sensitive, color-matching vinyl tape**].

Jacket material in following Paragraph meets USDA requirements for use in food-processing plants but may not comply with ASTM E84 flame-spread and smoke-developed ratings.

* + - * 1. Acrylonitrile Butadiene Styrene (ABS) Plastic Pipe Jacket:

Description:

One-piece, molded-type fitting covers and sheet material.

Color: Off-white.

Minimum Service Temperature: [**Minus 40**] <**\_\_\_\_\_\_\_\_**> degrees F.

Maximum Service Temperature: [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Water Vapor Permeance:

ASTM E96

0.02 perms

Thickness: [**30**] <**\_\_\_\_\_\_\_\_**> mils.

Connection: Brush-on welding adhesive.

Retain one of following two Paragraphs if Project includes piping located exterior to building or if insulation needs added protection from damage.

* + - * 1. Aluminum Pipe Jacket:

[**Comply with ASTM B209.**]

Sheet Thickness: [**0.016**] [**0.020**] [**0.025**] [**0.032**] [**0.040**] <**\_\_\_\_\_\_\_\_**> inch.

Finish: [**Smooth**] [**Embossed**] <**\_\_\_\_\_\_\_\_**>.

Joining: Longitudinal slip joints with 2-inch laps.

Fitting Covers:

Description: Die-shaped, with factory-attached protective liner.

Thickness: [**0.016**] <**\_\_\_\_\_\_\_\_**> inch.

Metal Jacket Bands:

Width: [**3/8**] [**1/2**] inch.

Thickness and Material: [**0.015**] <**\_\_\_\_\_\_\_\_**> inch, aluminum.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Thickness and Material: [**0.010**] [**0.020**] <**\_\_\_\_\_\_\_\_**> inch, stainless steel.

* + - * 1. Stainless-Steel Pipe Jacket:

Comply with [**ASTM A240**] [**or**] [**ASTM A666**].

Material: Type [**302**] [**304**] [**316**] stainless steel.

Thickness: [**0.010**] [**0.016**] [**0.018**] <**\_\_\_\_\_\_\_\_**> inch

Finish: [**Smooth**] [**Corrugated**].

Metal Jacket Bands:

Width: [**3/8**] [**1/2**] inch.

Thickness and Material: [**0.010**] [**0.020**] <**\_\_\_\_\_\_\_\_**> inch stainless steel.

* + - * 1. Field-Applied Glass-Fiber-Fabric Jacketing System:

Insulating cement/mastic.

Description: Hydraulic setting on mineral wool.

Comply with ASTM C195.

Glass-Fiber Fabric:

Cloth:

Untreated.

Weight: 9 oz./sq. yd

Blanket Density: 1 lb./cu. ft

Weave: [**5 by 5**] [**10 by 10**] [**10 by 20**].

Consider following Subparagraph for indoor vapor-retarder finish over insulation.

Indoor Vapor-Retarder Finish:

Description:

Type: Vinyl emulsion, acrylic.

Compatible with insulation.

Color: [**Black**] [**White**] <**\_\_\_\_\_\_\_\_**>.

Cloth:

Untreated.

Weight: 9 oz./sq. yd

* + - 1. PIPE INSULATION ACCESSORIES

Consider following Paragraph for vapor-retarder lap adhesive, used to seal laps and joints of vapor barrier jacket.

* + - * 1. Vapor-Retarder Lap Adhesive: Compatible with insulation.

Consider following Paragraph for adhesive mastic for PVC coverings, used to seal laps and joints of PVC covers.

* + - * 1. Covering Adhesive Mastic: Compatible with insulation.
				2. Piping 1-1/2-Inch Diameter and Smaller:

Description: Galvanized-steel insulation protection shield.

Comply with MSS SP-69, Type 40.

Length: Based on pipe size and insulation thickness.

* + - * 1. Piping 2-Inch Diameter and Larger:

Description: Wood insulation saddle, hard maple.

Inserts Length: Not less than 6 inches

Thickness and Contour: Match adjoining insulation.

* + - * 1. Closed-Cell Elastomeric Insulation Pipe Hangers:

Description: Polyurethane insert with [**aluminum**] [**stainless-steel jacket**] single-piece construction and self-adhesive closure.

Thickness: Match pipe insulation.

Retain following two Paragraphs if calcium-silicate-type pipe insulation is used on Project.

* + - * 1. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.
				2. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: Comply with ASTM C449.
				3. Insulating Cement:

Comply with ASTM C195.

Hydraulic setting on mineral wool.

* + - * 1. Adhesives: Compatible with insulation.
1. EXECUTION
	* + 1. EXAMINATION
				1. Verify that [**piping**] [**and**] [**equipment**] has been tested before applying insulation materials.
				2. Verify that surfaces are clean and dry, with foreign material removed.
			2. INSTALLATION - PIPING SYSTEMS
				1. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
				2. Fire-Rated Penetrations:

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.

* + - * 1. Piping Systems Conveying Fluids below Ambient Temperature:

Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, [**pump bodies,**] and expansion joints.

Jacketing:

Furnish factory-applied or field-applied vapor-retarder jackets.

Secure factory-applied jackets with pressure-sensitive adhesive with self-sealing longitudinal laps and butt strips.

Secure field-applied jackets with outward-clinch expanding staples, and seal stapled penetrations with vapor-retarder mastic.

Fittings, Joints, and Valves:

Insulate with molded insulation of like material and thickness as adjacent pipe.

Finish with glass cloth and vapor-retarder adhesive or PVC fitting covers.

* + - * 1. Glass-Fiber Board Insulation:

Apply insulation close to equipment by grooving, scoring, and beveling insulation.

Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface; on cold equipment, use vapor-retarder cement.

Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

* + - * 1. [**Polyisocyanurate Foam Insulation**] [**Extruded Polystyrene Insulation**]:

Wrap elbows and fitting with vapor-retarder tape.

Seal butt joints with vapor-retarder tape.

* + - * 1. Hot Piping Systems Less than [**140**] <**\_\_\_\_\_\_\_\_**> Degrees F :

Furnish factory-applied or field-applied standard jackets, securing with outward-clinch expanding staples or pressure-sensitive adhesive system on standard factory-applied jacket and butt strips, or both.

Fittings, Joints, and Valves:

Insulate with like material and thickness as adjoining pipe.

Finish with glass cloth and adhesive or PVC fitting covers.

Do not insulate unions and flanges at equipment; bevel and seal ends of insulation at such locations.

* + - * 1. Hot Piping Systems Greater than [**140**] <**\_\_\_\_\_\_\_\_**> Degrees F

Furnish factory-applied or field-applied standard jackets, securing with outward-clinch expanding staples or pressure-sensitive adhesive system on standard factory-applied jacket and butt strips, or both.

Fittings, Joints, and Valves:

Insulate with like material and thickness as adjoining pipe.

Finish with glass cloth and adhesive or PVC fitting covers.

Insulate flanges and unions at equipment.

* + - * 1. Inserts and Shields:

Piping [**1-1/2**] <**\_\_\_\_\_\_\_\_**>-Inch Diameter and Smaller: Install [**galvanized-**] steel shield between pipe hanger and insulation.

Piping [**2**] <**\_\_\_\_\_\_\_\_**>-Inch Diameter and Larger:

Install insert between support shield and piping, and under finish jacket.

Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.

Insert Material: Compression-resistant insulating material suitable for planned temperature range and service.

Piping Supported by Roller-Type Pipe Hangers: Install [**galvanized-**] steel shield between roller and inserts.

* + - * 1. Closed-Cell Elastomeric Insulation:

Push insulation onto piping.

Miter joints at elbows.

Seal seams and butt joints with manufacturer's recommended adhesive.

If application requires multiple layers, apply with staggered joints.

Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

* + - * 1. High-Temperature Pipe Insulation:

Install in multiple layers to meet scheduled thickness.

Attach each layer with bands, securing first layer with bands before installing next layer.

Stagger joints between layers.

Finish with canvas jacket [**sized for finish painting**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Cover with [**aluminum jacket**] [**stainless-steel jacket**] with seams located on bottom side of horizontal piping.

* + - * 1. Piping Exposed in Equipment Rooms or Finished Spaces [**(Less than 10 feet above Finished Floor)**]: Finish with [**canvas jacket sized for finish painting**] [**PVC jacket and fitting covers**] [**ABS jacket and fitting covers**] [**aluminum jacket**] [**stainless-steel jacket**].
				2. Piping Exterior to Building:

[**Provide vapor-retarder jacket.**]

Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass-mesh-reinforced, vapor-retarder cement.

Cover with [**aluminum**] [**stainless-steel**] jacket with seams located at 3- or 9-o'clock position on side of horizontal piping, with overlap facing down to shed water, or on bottom side of horizontal piping.

* + - * 1. Buried Piping:

Insulate only where insulation manufacturer recommends insulation product may be installed in trench or tunnel, or direct buried.

Install factory-fabricated assembly with inner all-purpose service jacket, with self-sealing lap, and asphalt-impregnated open-mesh glass fabric with 1-mil -thick aluminum foil sandwiched between three layers of bituminous compound.

Face outer surface with polyester film.

* + - * 1. Heat-Traced Piping Interior to Building:

Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe.

Size large enough to enclose pipe and heat tracing.

* + - * 1. Heat-Traced Piping Exterior to Building:

Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe.

Size insulation large enough to enclose pipe and heat tracing.

Cover with [**aluminum**] [**stainless-steel**] jacket with seams located at 3- or 9-o'clock position on side of horizontal piping, with overlap facing down to shed water.

* + - 1. ATTACHMENTS

When relying on separate schedules, tables, illustrations, or forms to specify product requirements, include list of each attachment. Include identical list of attachments in Project Manual table of contents.

Consider including schedule listing services applicable to Project. Select type of insulation, and indicate pipe size where insulation thickness varies with pipe size as well as appropriate types of equipment or devices to be insulated. List insulation materials permitted for each application, and indicate thickness for each permitted type of insulation. Because different insulation materials have different thermal resistances, services may be listed for several insulation materials.

Insert attachments following END OF SECTION.

Consider following example when developing Project schedule, which gives insulation types and thicknesses. Following example is not meant to cover every possible application, as in many cases various types of insulation can be used. Insulation thicknesses should be verified with application, fluid temperatures, and ambient temperatures.

Refer to ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings for pipe insulation thicknesses to meet applicable energy code requirements.

* + - * 1. Process Piping Insulation Schedule:

Chemical Piping:

Type: P-1.

Thickness:

Pipe Sizes 1-1/4 Inches and Smaller: 1/2 inch

Pipe Sizes 1-1/2 Inches and Larger: 1 inch

Potable Water:

Type P-1 or P-5.

Thickness:

Pipe Sizes 1-1/4 Inches and Smaller: 1/2 inch

Pipe Sizes 1-1/2 Inches and Larger: 1 inch

Deionized Water:

Type: P-1 or P-5.

All Pipe Sizes: 1 inch

END OF SECTION 404213