SECTION 404223 - PROCESS EQUIPMENT 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 equipment.

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

Equipment 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.

Section 404213 - Process Piping Insulation: Piping insulation and jacketing as it affects Work of this Section.

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

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

* + - 1. COORDINATION
         1. Coordinate Work of this Section with equipment [**and piping**] work.
      2. PREINSTALLATION MEETINGS
         1. Convene minimum [**one week**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
      3. 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.

Verify flame-spread index and smoke-developed index with types of insulation as specified in this Section.

* + - * 1. Test equipment insulation for maximum flame-spread index of [**25**] [**75**] <**\_\_\_\_\_\_\_\_**> and maximum smoke-developed index not exceeding [**50**] [**150**], according to ASTM E84.

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.
         2. Inspection: 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 manufactured fiber.

1. PRODUCTS
   * + 1. MANUFACTURERS
          1. Glass-Fiber and Mineral-Fiber Insulation:

[Manufacturers](http://www.specagent.com/LookUp/?ulid=8001&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=8002&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=8003&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=8004&mf=04&src=wd):

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

* + - * 1. Hydrous Calcium Silicate Insulation:

[Manufacturers](http://www.specagent.com/LookUp/?ulid=11612&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. EQUIPMENT INSULATION

Select insulation from following types, based on Project requirements and type of equipment.

* + - * 1. Semi-rigid Glass Fiber:

Comply with ASTM C795.

Maximum Thermal Conductivity: [**0.26**] <**\_\_\_\_\_\_\_\_**> Btu-in./h-sq.-ft.-deg. F at 75 degrees F

Operating Temperature Range: Zero to 850 degrees F

Vapor Barrier Jacket:

Description: Reinforced foil kraft with self-sealing adhesive joints.

Comply with ASTM C1136, Type I.

Jacket Temperature Limits: Minus 20 to 150 degrees F

* + - * 1. Flexible, Closed-Cell Elastomeric:

Type: Sheet.

Comply with ASTM C534, Type II.

Maximum Thermal Conductivity: [**0.27**] [**0.30**] <**\_\_\_\_\_\_\_\_**> Btu-in./h-sq.-ft.-deg. F at 75 degrees F

Operating Temperature Range: Minus 70 to 180 degrees F

Adhesive: As recommended by insulation manufacturer.

UV Protective Coating: As recommended by insulation manufacturer.

* + - * 1. Flexible, Nonhalogen, Closed-Cell Elastomeric:

Type: Sheet.

Comply with ASTM C534, Type II.

Maximum Thermal Conductivity: [**0.27**] <**\_\_\_\_\_\_\_\_**> Btu-in./h-sq.-ft.-deg. F at 75 degrees F

Maximum Service Temperature: 250 degrees F

Operating Temperature Range: Minus 58 to 250 degrees F

* + - * 1. Preformed Mineral Fiber:

Noncombustible.

Comply with ASTM C612, Type IB.

Minimum Density: 3 pcf

Maximum Thermal Conductivity: [**0.40**] <**\_\_\_\_\_\_\_\_**> Btu-in./h-sq.-ft.-deg. F at 75 degrees F

Maximum Service Temperature: 450 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. Polyisocyanurate Foam:

Comply with ASTM C591, Type IV.

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

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

Operating Temperature Range: Minus 297 degrees F 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**] <**\_\_\_\_\_\_\_\_**> perm

* + - * 1. Extruded Polystyrene:

Comply with ASTM C578, Type XIII.

Maximum Thermal Conductivity: 180-day aged value of [**0.259**] <**\_\_\_\_\_\_\_\_**> Btu-in./h-sq.-ft.-deg. F at 75 degrees F

Operating Temperature Range: Minus 297 degrees F 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**] <**\_\_\_\_\_\_\_\_**> perm

* + - * 1. Hydrous Calcium Silicate:

Rigid molded.

Color: White.

Asbestos-free.

Comply with ASTM C533, Type [**I**] [**II**].

Maximum Thermal Conductivity: [**0.45**] <**\_\_\_\_\_\_\_\_**> Btu-in./h-sq.-ft.-deg. F at 200 degrees F

Operating Temperature Range: 140 to 1,200 degrees F

* + - 1. JACKETING
         1. Vapor-Retarder Jacket:

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

[**Comply with ASTM C921.**]

Water Vapor Permeance:

Comply with ASTM E96

[**0.02**] <**\_\_\_\_\_\_\_\_**> perm

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

* + - * 1. PVC Jacket:

Description:

Sheet.

UV resistant.

Color: [**White**] [**Off-white**].

Material: PVC.

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) Jacket:

Description:

Sheet.

Color: Off-white.

Material: ABS.

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

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

Water Vapor Permeance:

Comply with ASTM E96

[**0.02**] <**\_\_\_\_\_\_\_\_**> perm

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

Connection: Brush-on welding adhesive.

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

* + - * 1. Aluminum Jacket:

[**Comply with ASTM B209.**]

Sheet Thickness: [**16**] [**20**] [**25**] [**32**] [**40**] <**\_\_\_\_\_\_\_\_**> mils.

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

* + - * 1. Stainless-Steel Jacket:

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

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

Thickness: [**10**] [**16**] [**18**] <**\_\_\_\_\_\_\_\_**> mils

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

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

Description: Hydraulic setting on mineral wool; insulating cement/mastic.

Comply with ASTM C195.

Glass-Fiber Fabric:

Cloth:

Untreated.

Weight: 9 oz./sq. yd.

Blanket Density: 1 pcf

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. ACCESSORIES

Consider following Paragraph for vapor-retarder lap adhesive, used to seal laps 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. 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. EXECUTION
   * + 1. EXAMINATION
          1. Verify that [**piping**] [**and**] [**equipment**] [**has**] [**have**] been tested before applying insulation materials.
          2. Verify that surfaces are clean and dry, with foreign material removed.
       2. INSTALLATION
          1. Equipment Exposed to View in Finished Spaces: Locate insulation or jacket seams in least visible locations.
          2. Insulate entire equipment system, including fittings, nozzles, [**pump bodies,**] and expansion joints.
          3. Multiple Layers:

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.

* + - * 1. Jacketing:

Cover with [**PVC**] [**ABS**] [**aluminum**] [**stainless-steel**] jacket.

Secure jackets with pressure-sensitive adhesive.

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

Fasten insulation to equipment with 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**]: Seal seams with vapor-retarder tape.
        2. Closed-Cell Elastomeric Insulation: Seal seams with manufacturer's recommended adhesive.
      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 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 insulation thicknesses to meet applicable energy code requirements.

* + - * 1. Process Equipment Insulation Schedule:

Wastewater Evaporator:

Material: Mineral Fiber.

Thickness: 1/2 inch

Jacket Material: PVC.

Oil-Water Separator:

Material: Polyisocyanurate Foam.

Thickness: 1 inch

Jacket Material: Stainless Steel.

END OF SECTION 404223