

**SECTION 23 07 19
HVAC PIPING INSULATION**

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

- A. Furnish and install all piping insulation, vapor barriers, jackets, finishes, adhesives, cements and accessories to make a complete insulated system for all piping, valves, fittings, joints, offsets and flanges specified herein.
- B. All insulation system materials shall conform to the maximum flame spread/smoke developed ratings specified herein.
- C. Hard insulation material shall be provided at all hangers.
- D. Insulate the following:
 - 1. All scheduled piping, all valves, fittings, elbows, flanges and accessories.
 - 2. All piping exposed to weather including provision of additional weatherproof jacket.
 - 3. All condensate drains from air conditioning units.
 - 4. Piping jacket covers.

1.03 RELATED SECTIONS

- A. Examine all drawings and criteria sheets and all other Section of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.
- B.

1.04 REFERENCES

- A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.
- B. Material standards shall be as specified or detailed hereinafter and as follows:
 - 1. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Steel and Plate.
 - 2. ASTM B 209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and plate (Metric).
 - 3. ASTM C240 – Standard Test Methods of Testing Cellular Glass Insulation Block.
 - 4. ASTM C533 – Standard Specification for Calcium Silicate Block and Pipe Terminal Insulation.
 - 5. ASTM C 534 – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 6. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.
 - 7. ASTM C552 – Standard Specification for Cellular Glass Thermal Insulation.
 - 8. ASTM C578 – Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation.
 - 9. ASTM C591 – Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - 10. ASTM C610 – Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
 - 11. ASTM C795 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

12. ASTM C 921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
13. ASTM D1667 – Standard Specification for Flexible Cellular Materials – vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
14. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
15. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E 96 – Standard Test Methods for Water Vapor Transmission Materials.
17. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials.
18. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.
19. ANSI/ASHRAE 90.1 – Energy Conservation in New Buildings.

1.05 SUBMITTALS

- A. See Section 230500 and General Conditions for Additional Requirements.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.
- D. Installation Graphic Details.

1.06 QUALITY ASSURANCE

- A. All insulation materials, finishes, coatings, cements, jackets and other insulation accessories shall have minimum composite or individual fire hazard ratings as well as thickness and "C" values conforming to State Building Codes which control building construction materials that may be used on this project. Where specification requirements exceed the Code requirements, the specification shall govern.
- B. Piping insulation for the various piping systems and associated equipment shall be composed of materials which are non-combustible and/or provide a fire resistive system of insulation which complies with the applicable Code having jurisdiction. Generally, it is required that fire hazard ratings shall not exceed the following, except as noted:
 1. Flame Spread Rating 25 (No Exceptions)
 2. Smoke Developed Rating: 50
- C. All fire hazard ratings shall be as determined by NFPA 255 "Method of Test of Surface Burning Characteristics of Building Materials", ASTM E84 or UL 723.
- D. All insulation materials herein specified shall be used subject to the manufacturer's temperature limitations and their compatibility with other materials.
- E. Installation of all insulation work shall be executed by a qualified Insulation Contractor who is thoroughly experienced in this particular type of work and who has adequate facilities and equipment for installation of all insulation work herein specified and who is familiar with the requirements of the Code enforcing Authorities as to fire hazard rating.
- F. The finished installation shall present a neat and workmanlike appearance with all jackets smooth, with all vapor barriers sealed and intact.
- G. Where insulation is specified for piping, insulate similarly all connections, vents, drains and any piping connected to system subject to heat loss or gain. Do not cover vent petcocks, cleanouts or other maintenance points on equipment unless identified on the insulation with removable access panels or covers.

1.07 REGULATORY REQUIREMENTS

- A. Conform to maximum flame spread/smoke developed rating of 25/50 inch accordance with ASTM E84, NFPA 255, or UL 723.

1.08 DELIVERY, STORAGE AND PROTECTION

- A. A. Accept materials on site, labeled with manufacturer's identification, product density and thickness.
- B. All materials shall be stored in a dry area free from moisture and debris.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during and after installation for minimum of 24 hours.

PART 2 – PRODUCTS

2.01 MANUFACTURERS ACCEPTABLE FOR PRODUCT TYPES INDICATED CONTINGENT UPON PRODUCTS' COMPLIANCE WITH THE SPECIFICATIONS

- A. Insulation:
 - 1. Manville Corporation.
 - 2. Owens-Corning Fiberglass Corporation.
 - 3. Armstrong World Industries, Incorporated.
 - 4. Certaineed Corporation.
 - 5. Knauf
 - 6. Or approve equal
- B. Mastics and adhesives:
 - 1. Childers Products Company.
 - 2. H. B. Fuller Company, Foster Products Division.
 - 3. 3M Company Adhesives, Coatings and Sealers.
 - 4. Armstrong World Industries, Incorporated.
 - 5. Ruston Plant.
 - 6. Chicago-Mastic
 - 7. Insul-Coustic
 - 8. St. Clair Rubber
 - 9. Vimasco
 - 10. Baldwin-Ehret-Hill
 - 11. Or approve equal
- C. Pipe insulation of hanger and support:
 - 1. Pipe Shields, Inc.
 - 2. Rilco Manufacturing Company.
 - 3. Elcen Metal Products Company.
 - 4. Power Piping Company.
 - 5. NPS Industries.
 - 6. Or approve equal
- D. PVC fitting covers:
 - 1. Manville, Corporation.
 - 2. Certaineed, Corp.
 - 3. Cell Co. Plastics
 - 4. Or approve equal

2.02 GENERAL

2.03 REFERENCE STANDARDS

- A. ASTM C240 - Standard Test Methods for Testing Cellular Glass Insulation Block; 2021.
- B. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).
- C. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
- E. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- F. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- G. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.
- H. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
- I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- J. ASTM D828 - Standard Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus; 2016, with Editorial Revision (2018).
- K. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
- L. ASTM D1667 - Standard Specification for Flexible Cellular Materials—Poly (Vinyl Chloride) Foam (Closed-Cell); 2022.
- M. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2025.
- N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
- P. Adhesives and insulation materials: Composite fire and smoke hazard ratings maximum 25 for flame spread and 50 for smoke developed for pipe insulation. Adhesives to be waterproof when cured.
- Q. The installation of thermal insulating materials coverings and coatings containing asbestos fibers is forbidden.
- R. Insulation shall not be chemically reactive to the metal over which it is applied. Insulation installed on steel shall be neutral or slightly alkaline. Insulation installed on aluminum shall be neutral or slightly acidic.

2.04 MATERIALS AND COMPONENTS

- A. Fiberglass insulation:
 - 1. Premolded pipe fiberglass: Recommended temperature to 850 degrees Fahrenheit with facing. Molded in one piece split or hinged circular sections in three foot lengths for piping and tubing. Insulation shall be made from long, fine, glass fibers bonded together with a thermosetting resin. Insulation shall have a minimum density of 4.0 pounds per cubic foot and a Thermal Conductivity value of 0.27- 0.30 -Inch/HrSq.FtDef.F at 75 degrees Fahrenheit mean temperature. Insulation furnished with facing as specified below and as indicated in insulation schedule. Insulation similar to Owens-Corning Type SSL-II.

Pressure sensitive tapes using rubber based or acrylic based adhesives are not permitted.

2. Pipe and tank fiberglass: Recommended temperature to 450 degrees Fahrenheit with facing. Insulation shall be made from long, fine, glass fibers bonded together with a thermosetting resin. Insulation shall have a minimum density of 3 pounds per cubic foot and a k-value of 0.27 btu in/(Hr sq.ft. degree F) at 75 degrees Fahrenheit mean temperature. Insulation furnished with facing as specified below and as indicated in insulation schedule. Insulation similar to Manville pipe and tank insulation. Pressure sensitive tapes using rubber based or acrylic based adhesives are not permitted.
3. Use pipe and tank fiberglass only when premolded pipe fiberglass is not available. Pipe and tank insulation shall not be used on pipe sizes 24 inches and smaller.
4. Cellular Foam Glass: Insulation shall have a thermal conductivity not exceeding 0.26 btu in/(Hr sq.ft. degree F) at 75 degrees Fahrenheit mean temperature. Water absorption shall be less than 5% (ASTM D1056). Water vapor permeability shall not exceed 0.10 perms per inch in accordance with ASTM E 96 Procedure A. The insulation shall meet the requirements of ASTM C534 and ASTM D1056. Where insulation is installed outdoors, coatings shall be provided to protect the insulation from ultraviolet radiation. Coatings shall be as recommended by the insulation manufacturer and approved by the engineer.

B. Insulation facing:

1. Code ASJ: All service jacket composed of high intensity white chemically treated Kraft paper reinforced with fiberglass yarn and mesh and laminated to aluminum foil with a fire retardant adhesive. Longitudinal laps and butt strips shall be a minimum of 3 inches.
2. Code FSKL: 0.35 mil aluminum foil reinforced with fiberglass yarn reinforcing scrim and laminated to chemically treated fire resistive Kraft paper having a minimum 35 pound per inch width tensile strength when tested in accordance with ASTM D828. Water vapor permeability 0.04 perms. Longitudinal laps and butt strips shall be a minimum of 3 inches.

C. Additional insulation jacket:

1. ADJ-3a: 0.016 inch thick aluminum jacket conforming to ASTM B-209 with a 1 mil factory applied poly-kraft moisture barrier. Longitudinal joints shall be placed at the side of the pipe facing downward at either the 4 o'clock or 8 o'clock position so as to shed water. Aluminum fitting covers, two piece elbows, tees, valve and flange covers, etc., with a 1 mil poly-kraft or acrylic vapor barrier.
2. ADJ-4: 20 mil PVC jacket suitable for all types of paint. Similar to Manville Zeston 25/50.
3. ADJ-5: shall be a Cell-Co plastic jacket with the following color coded pattern:
 - a. Steam (LP): White
 - b. Condensate (Pump/Gravity): White
 - c. Other Yellow-green
4. ADJ-7: 0.16-inch thick type T-316 stainless steel jacket. Alloys conforming to ASTM A-240. System shall have a 3-mil polykraft vapor barrier.

D. Adhesives:

1. Code ADH-2: Fast-drying vinyl base coating and lagging adhesive. Similar to Childers CP-50A HV2.
2. Code ADH-3: Fast-drying neoprene base adhesive for lap joints of foil-faced facing applied over pipe insulation. Similar to Childers CP-82.

E. Caulking components:

1. Code CC-1: For use with foam glass and/or joint sealant applications. Flexible elastomeric vapor barrier sealant. Similar to Childers CP-76.

F. Mastics:

1. Code MAS-1: Vapor barrier mastic made with an elastomeric resin. For indoor use. Similar to Childers CP-30.
2. Code MAS-2: A non-water vapor barrier asphaltic emulsion coating, breathing type, for above ground installations. Similar to Childers CP-10.
3. Code MAS-3: Vapor barrier mastic made with an elastomeric resin. For outdoor use.

- G. Tie wire:
 1. Tie wire for securing insulation in place shall be type 304 stainless steel annealed steel wire of gauge and proper spacing as recommended by the insulation manufacturer. Wire shall be drawn up tightly enough to become embedded in the insulation and the ends of the loop twisted, bent over, and pressed into the insulation so as to leave no ends protruding.
- H. Banding:
 1. 3/8 inch x 0.02 inch type 304 stainless steel for pipe insulation.
 2. 3/4 inch x 0.02 inch type 304 stainless steel for additional insulation jackets.
- I. Wire mesh:
 1. Wire mesh shall be one inch by No. 20 BGW hexagonal mesh galvanized.
 2. Expanded metal: Expanded metal shall be 1/2 inch Hi-Rib metal lath of copper bearing steel.
- J. Tape:
 1. Lead foil tape shall be 3M Company Lead Foil Tape No. 422, 4 mil thick, acrylic adhesive, 2 inch wide.
 2. Vinyl plastic tape, silver gray, flame resistant, vapor barrier sealant tape on rigid and flexible insulation material for warm or cold air ducts. Similar to 3M Company Duct Sealing Tape No. 474.
 3. Aluminum foil tape, dead soft aluminum foil, point seal on stick pin, metal patching, moisture barrier, heat reflecting and general sealing on aluminum facing foil. Similar to 3M Company Aluminum Foil Tape No. 425.
- K. Staples:
 1. Staples shall be galvanized clad outward clinching insulation staples.
- L. Finishing cement:
 1. Finishing cement ASTM C449 shall be diatomaceous silica thermal insulating materials with a suitable proportion of heat resistant binder, hydraulic setting insulating cement capable of withstanding maximum temperature of 700 degrees Fahrenheit. When mixed with water it shall be a plastic mix suitable for trowel applications and shall present a hard, smooth and durable surface after drying. Similar to PABCO No. 127.
- M. Combination insulating and finishing cement:
 1. Similar to Ryder One Coat or equal.

PART 3 – EXECUTION

3.01 PREPARATION

- A. No insulation shall be applied until the surfaces of the equipment to be insulated are thoroughly cleaned and until pipes and equipment to be insulated have been leak tested and proven tight and accepted by THE ENGINEER
- B. Insulation shall not be applied to piping or equipment until authorization is given to the Contractor by THE ENGINEER. Contractor shall submit a request for authorization. If any insulation is applied without first obtaining authorization, it will be the Contractor's responsibility to remove the insulation and apply it again if so directed.
- C. Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.
- D. The execution of the insulation work shall be in strict accordance with the best practices of the trade and with the specifications.
- E. The insulation shall be handled and applied in a manner that will not adversely affect its structural or insulating properties.
- F. The installation instructions provided by the insulation material manufacturer of all materials specified in this Section shall be followed when installing these materials. Where the

specifications are in conflict with manufacturers' instructions, such conflicts shall be brought to the attention of the ENGINEER for a decision.

- G. Welding operations will not be permitted on certain specific items of equipment, piping and components for the application of studs, pins, support rings, angles, etc. Contractor shall obtain permission in writing from THE ENGINEER to perform any welding.
- H. Coat to seal all insulating cement and calcium silicate surfaces with primer similar to Childers CP-53 or equal before applying any mastic coating.

3.02 PIPING INSULATION INSTALLATION

- A. Ensure insulation is continuous through interior walls. Pack around pipes with fire proof self-supporting insulation material, fully sealed. Insulation on all cold surfaces where vapor barrier jackets are specified must be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, and other heat conductive parts that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- B. Insulate fittings, valves, unions, flanges, and strainers. Do not insulate flexible connections and expansion joints. Terminate insulation neatly with PVC or aluminum end caps.
- C. Premolded fiberglass insulation for straight pipes shall be applied, neatly fitted around piping and sealed with adhesive ADH-3. Adhesive shall be applied to only one side of each joint and shall not be applied to the pipe surface.
- D. Where two sections of pipe insulation butt together provide a 3 inch wide butt strip of same facing material as adjacent insulation facing. Adhere neatly in place using adhesive ADH-3.
- E. All pipe elbows shall be insulated with short radial and mitered pieces of board or block insulation or premolded pieces of pipe insulation. Each piece shall be butted tightly against the adjoining piece and all joints, seams, voids and irregular surfaces shall be filled with insulating cement finished to a smooth, hard and uniform contour. Coat with MAS-1 mastic and reinforce with additional jacket. In addition, place a fitted PVC cover (ADJ-4) over insulated elbow exception. Tape elbow to adjoining insulation.
- F. All valves and fittings shall be insulated with premolded fittings, sectional pipe insulation, or blocks of the same material and thickness as used for the adjacent pipe. Flange insulation shall overlap the adjoining pipe insulation by not less than the thickness of the pipe insulation. Sectional pipe covering or block insulation shall be cut to fit, and each section butted closely to the next and held in place with tie wire.
- G. Fittings on pipe lines in finished and concealed areas shall be covered with premolded fiberglass pipe fitting insulators Insul-Coustic or equal, where sizes are available, otherwise, use mitercut segments of molded pipe insulation, wire in place with joints and raw edges sealed with adhesive and smoothed out with a coat of insulating cement.
- H. Insulation shall cover the entire surface of the fittings and bodies of the valves up to and including the bonnets, and to the valve stuffing box studs, bolts, or nuts. All joints, seams, and irregular surfaces shall be filled with insulating cement. The insulated surfaces shall be covered with a 1/4 inch thick layer of finishing cement and heavily coated with vapor barrier mastic MAS-1 for cold services and mastic MAS-2 for hot services and reinforced with additional jacket. Mastic shall be trowelled to a smooth and well-shaped contour compatible with adjoining pipe insulation jackets as specified.
- I. Use ADJ-4 covers over fittings and flanges everywhere except when ADJ-3a or ADJ-5 is specified.
- J. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship on all joints of all piping.
- K. All instrument connections for thermometers, thermocouples, gauges, test connections, flow meters, etc., on insulated pipes, vessels, or equipment shall be insulated. The insulation shall be shaped at these connections by tapering it to and around the connection with insulating

cement and finishing with finishing cement, vapor barrier adhesive, applicable mastic, or caulking compound.

- L. Where removable flange and valve insulation is required or specified, installation shall conform to the following:
1. Removable flange insulation shall be made from sectional pipe insulation of the same thickness as that on the adjoining pipe or from block insulation 1/2 inch thinner than the pipe insulation and finished with insulating cement. Insulation jackets shall be the same as adjoining pipe insulation unless indicated otherwise.
 2. When flange covers are made from sectional pipe insulation, they shall enclose the flanges and be long enough to extend at least 2 inches over the adjacent pipe insulation on each side of the flange. The space between the flange cover and the pipe insulation shall be filled with insulating cement. Secure the flange cover in place with stainless steel banding.
 3. When flange covers are made from block insulation, they shall be made in two halves. Each half shall consist of mitered blocks wired to 1/2 inch galvanized hardware cloth mesh. This wire frame, with its attached insulation, shall then be secured to the flanges with tie wire. The insulation cover shall be long enough to extend at least 2 inches over the adjacent pipe insulation on each side of the flange. The space between the flange cover and the pipe insulation shall be filled with insulating cement. The whole flange cover assembly shall be finished with 1/2 inch of insulating cement applied in two coats. After the first coat is dry, the second coat shall be trowelled to a smooth hard finish. All surfaces shall then be finished with jackets as specified in the schedule.
 4. Removable valve insulation covers shall be constructed in the same manner as for flanges with the following exception; the two part section shall be divided on the vertical center line of the valve body, bonnet, flange or joint.
 5. When specified to insulate the complete valve, the hand wheel or lug wrench shall be removed to accommodate the valve bonnet box. The valve bonnet box shall be constructed in a one piece closure, one end closed, one end opened to fit up to the valve body insulation. Securing the valve and bonnet box sections, sealing and pointing of the insulation shall be done in same manner as specified for flange covers.
 6. Unless indicated as removable, a permanent installation as previously specified shall be used.
 7. Protect insulation on piping 2 1/2" and up where supported in hangers by means of calcium silicate rigid pipe insulation or jackets. Saddles or shaped galvanized steel pieces approximately 10" long by half the circumferences of insulated pipe.
 8. All piping shall have been tested and approved prior to installation of insulation.
 9. All piping or surfaces where subject to condensation on the outside shall be insulated including vaporseal finish.

PART 4 – SCHEDULES

4.01 PIPING INSULATION SCHEDULE: (ASJ = "ALL-SERVICE-JACKET")

Service	Type Insulation and Thickness (Inches)	Facing	Additional Jacket*
Steam Condensate (All Pressures)	Molded Fiber Glass 2 1/2	ASJ	
Refrigerant Piping and Air Conditioner	Cellular Foam Glass	ASJ	

Service	Type Insulation and Thickness (Inches)	Facing	Additional Jacket*
Condensate Drain Piping System	1		

- A. *Including elbows, fittings, valves, complete system.
1. Piping exposed to weather shall be provided with weatherproof jacket.

END OF SECTION 23 07 19 23 07 19