

SECTION 15080

HVAC INSULATION

PART 1 –GENERAL

1.1 SUMMARY

- A. Section includes ductwork insulation, duct liner insulation jackets, equipment insulation, covering, breeching insulation, thermal insulation for piping systems including vapor retarders, jackets and accessories.
- B. Related Sections:
 - 1. Section 09050 – Paints and Coatings: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

- A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]).
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- E. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- F. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- G. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- H. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- I. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation.
- J. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

- K. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- L. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation.
- M. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
- N. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation.
- O. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- P. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- Q. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
- R. ASTM C1126- Standard Specification for Preformed Closed Cell Phenolic Foam Pipe and Board Insulation.
- S. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- T. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- V. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- W. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- X. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- Y. NAIMA (North American Insulation Manufacturers Association) - National Insulation Standards.

- Z. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Provide product description, thermal characteristics and list of materials and thickness for each service, and locations.
- C. Manufacturer's Installation Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing work of this section with minimum three years documented experience.

1.5 PRE-INSTALLATION MEETING

- A. Section 01330 -Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation outside ambient conditions required by manufacturer of each product.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Section 01770 - Execution Requirements: Product warranties and product bonds.
- B. Provide five year manufacturer warranty for man made fiber.

PART 2 –PRODUCTS

2.1 MANUFACTURERS

- A. Insulation
 - 1. Owens Corning
 - 2. Certainteed
 - 3. Schuller
 - 4. Armstrong
 - 5. Or equal
- B. PVC Jackets
 - 1. Schuller
 - 2. Speedline
 - 3. or equal
- C. Fire Rated Duct System
 - 1. 3M Firemaster
 - 2. or equal
 - 3.
- D. Duct Liner – No Fiberglass in Air Stream, install Mylar Coated Duct Liner

2.2 MAN MADE MINERAL FIBER

- A. Insulation: ASTM C547 Mineral Fiber Pipe Insulation, Type I 850(454), Type II 1200(650), Type III 1200(650). Conform to ASTM C795 for application on Austenitic stainless steel.
- B. Insulation: ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. 'K' ('ksi') factor: ASTM C177, 0.24 at 75 degrees F
 - 2. Maximum service temperature: 650 degrees F.
 - 3. Maximum moisture absorption: 0.2 percent by volume.

- C. Vapor Retarder Jacket:
 - 1. ASTM C921, White Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Retarder Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic:
 - 1. ASTM C195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Blanket: 1.0 lb/cu ft density.
 - 3. Weave: 5x5.
- H. Indoor Vapor Retarder Finish:
 - 1. Cloth: Untreated; 9-oz/sq yd weight.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, color TBD.
- I. Outdoor Vapor Retarder Mastic: Compatible with insulation.
- J. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- K. Outdoor Breather Mastic: Compatible with insulation.
- L. Vinyl emulsion type, black acrylic or mastic, compatible with insulation.
- M. Insulating Cement: ASTM C449/C449M.

2.3 MAN MADE MINERAL FIBER, FLEXIBLE BLANKET OR BATTS

- A. Insulation: ASTM C553; Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications. Type I, Type II, or Type III, depending on design.
- B. Vapor Retarder Jacket: ASTM 1136, Type II Flexible and Low Permeance Vapor Retarders for Thermal Insulation.
 - 1. For systems operating at temperatures below ambient, close and secure seams and joints. If outward clinching staples are used, then the staple penetrations must also be sealed.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Retarder Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic:

1. ASTM C195; hydraulic setting on mineral wool.

2.4 MINERAL FIBER, FLEXIBLE INSULATION FOR THE EXTERIOR OF SHEET METAL DUCTS

A. Insulation: ASTM C553 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications, Type II.

B. Vapor Retarder Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film or 0.0032 inch vinyl.
2. Moisture vapor transmission: ASTM E96; 1.3 perm.
3. Secure with pressure sensitive tape.

C. Vapor Retarder Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Outdoor Vapor Retarder Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

E. Tie Wire: Annealed steel, 16 gage.

2.5 MINERAL FIBER, RIGID INSULATION FOR THE EXTERIOR OF SHEET METAL DUCTS.

A. Insulation: ASTM C612 Mineral Fiber Block and Board Insulation, Type IA

B. Vapor Retarder Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film or 0.0032 inch vinyl.
2. Moisture vapor transmission: ASTM E96; 1.3 perm.
3. Secure with pressure sensitive tape or two coats of vapor barrier mastic and glass tape.

C. Vapor Retarder Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Indoor Vapor Retarder Finish:

1. Cloth: Untreated; 9-oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black or white color.

2.6 CELLULAR GLASS

A. Insulation: ASTM C552, Type II – pipe and tubing insulation, Class 2 - Jacketed.

1. 'K' factor: ASTM C177 or ASTM C518, 0.29 at 75 degrees F. GLASS FIBER, RIGID

B. Insulation: ASTM C612 [or ASTM C592]; rigid, noncombustible

1. 'K' factor: ASTM C177 or ASTM C518, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 450 F degrees.
3. Maximum Moisture Absorption: 0.1 percent by volume.
4. Density: 3.0lb/cu ft.

C. Vapor Retarder Jacket: ASTM C1136 Flexible, Low Permeance Vapor Retarders for Thermal Insulation, Type II.

D. Facing: 1 inch stainless steel hexagonal wire mesh stitched on one face of insulation.

E. Vapor Retarder Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.7 EXPANDED PERLITE

A. Molded Expanded Perlite Block and Pipe Insulation: ASTM C610, Pipe Insulation.

2.8 HYDROUS CALCIUM SILICATE

A. Calcium Silicate Block and Pipe Thermal Insulation: ASTM C533, Type II – for use on surfaces up to 1200 F.

B. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

C. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement:

1. ASTM C449/C449M.

2.9 CELLULAR POLYISOCYANURATE THERMAL INSULATION

A. Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation: ASTM C591, Type III, compressive strength 50 psi(345 kPa)

2.10 CELLULAR PHENOLIC FOAM

- A. Faced or Unfaced Rigid Cellular Phenolic Pipe and Board Thermal Insulation, ASTM C1126, Type II and Type III.

2.11 ELASTOMERIC CELLULAR FOAM

- A. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534; Type I, Tubular form
- B. Elastomeric Foam Adhesive:
 - 1. Air dried, contact adhesive, compatible with insulation.

2.12 PVC PLASTIC.

- A. Pipe Jacket: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
 - 1. Thickness: 30 mil
 - 2. Connections: Brush on welding adhesive, Tacks or Pressure sensitive color matching vinyl tape.
- B. Equipment Jacket: Sheet material, off-white color.
 - 1. Minimum Service Temperature: -40 degrees F.
 - 2. Maximum Service Temperature: 150 degrees F.
 - 3. Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.
 - 4. Thickness: 30 mil.
 - 5. Connections: Brush on welding adhesive, Tacks or Pressure sensitive color matching vinyl tape.
- C. Covering Adhesive Mastic: Compatible with insulation.
- D. ABS Plastic:
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum service temperature: -40 degrees F.
 - b. Maximum service temperature of 180 degrees F.
 - c. Moisture vapor transmission: ASTM E96; 0.012 perm-inches.
 - d. Thickness: 30 mil.
 - e. Connections: Brush on welding adhesive.
- E. Canvas Jacket: UL listed.
 - 1. Fabric: 6 oz/sq yd, plain weave cotton.
 - 2. Fire retardant lagging adhesive. Composite of insulation, jacket and lagging adhesive shall have a flame spread index not greater than 25 and a smoke developed index not greater than 50 per ASTM E84.
- F. Lagging Adhesive: Compatible with insulation.

G. Aluminum Jacket: ASTM B209.

1. Thickness: 0.016 inch thick sheet.
2. Finish: Smooth or Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

H. Stainless Steel Jacket: ASTM A167 316 stainless steel.

1. Thickness: 0.018 inch thick.
2. Finish: Smooth or Corrugated.
3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

I. Mineral Fiber (Outdoor Duct) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

2.13 GLASS FIBER DUCT LINER, FLEXIBLE INSULATION FOR THE INTERIOR OF SHEETMETAL DUCTS.

A. Insulation: ASTM C1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material), Type I

B. Adhesive:

1. Waterproof, ASTM E162 fire-retardant type.

C. Liner Fasteners: Galvanized steel, self-adhesive pad, with integral press-on head.

2.14 GLASS FIBER DUCT LINER, BOARD INSULATION FOR THE INTERIOR OF SHEET METAL DUCTS.

A. Insulation: ASTM C1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material), Type II.

B. Adhesive:

1. Waterproof ASTM E162 fire-retardant type.

C. Liner Fasteners: Galvanized steel, self-adhesive pad, impact applied or welded with integral press-on head.

2.15 GLASS FIBER ROUND DUCT LINER

- A. Insulation: Round, preformed in cylindrical sections with polyvinyl acetate polymer or acrylic polymer meeting ASTM G21 impregnated surface coat.
 - 1. 'K' factor: ASTM C1071, 0.23 at 75 degrees F.
 - 2. Maximum service temperature: 250 degrees F.
 - 3. Maximum Velocity on Coated Air Side: 4,000 fpm.

PART 3 –EXECUTION

3.1 EXAMINATION

- A. Section 01330 - Administrative Requirements: Coordination and project conditions.
- B. Verify that piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with NAIMA National Insulation Standards.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- D. Man made mineral fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide factory-applied or field-applied vapor retarder jackets. Secure factory applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal all staple penetrations with vapor retarder mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- E. For hot piping conveying fluids over 140 degrees F insulate flanges and unions at equipment.
- F. Man made mineral fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or the pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:

1. Application: Piping or Equipment all piping
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Compression resistant insulating material suitable for the planned temperature range and service.

H. Continue insulation through penetrations of building assemblies or portions of assemblies having a fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Section 07270 for penetrations of assemblies with a fire resistance rating greater than one hour.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

J. Exterior Applications: 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 jacket with seams located at the 3 or 9 o'clock position on the side of horizontal piping with the overlap facing down to shed water or on the bottom side of horizontal equipment.

K. Buried Piping: Insulate only where the manufacturer of a specific insulation recommends that their product may be installed either in a trench, tunnel or direct buried. Provide 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; outer surface faced with a polyester film.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Provide a size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at the 3 or 9 o'clock position on the side of horizontal piping with the overlap facing down to shed water.

M. Factory Insulated Equipment: Do not insulate.

N. Exposed Equipment: Locate insulation and cover seams in least visible locations.

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

- Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- P. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
 - Q. Insulated equipment that contains fluids below ambient temperature: Insulate entire system.
 - R. Mineral fiber insulated equipment that contains fluids below ambient temperature: Provide vapor retarder jackets, factory-applied or field-applied. Finish with glass-cloth and vapor barrier adhesive
 - S. For hot equipment that contains fluids over 110 degrees F, insulate flanges and unions with removable sections and jackets.
 - T. Mineral fiber insulated equipment that contains fluids above ambient temperature:
 - U. Provide standard jackets, with or without vapor retarder, factory-applied or field applied. Finish with glass cloth and adhesive.
 - V. Finish insulation at supports, protrusions, and interruptions.
 - W. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
 - X. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
 - Y. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.
 - Z. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
 - AA. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor retarder jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
 - BB. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket.

CC. Exterior Applications: Provide insulation with vapor retarder jacket. Cover with outdoor jacket finished as specified in Section with caulked aluminum jacket with seams located on bottom side of horizontal duct section.

DD. External Duct Insulation Application:

1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

EE. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 THICKNESS

A. Provide insulation thicknesses per California Energy Commission (CEC) Title-24.

END OF SECTION